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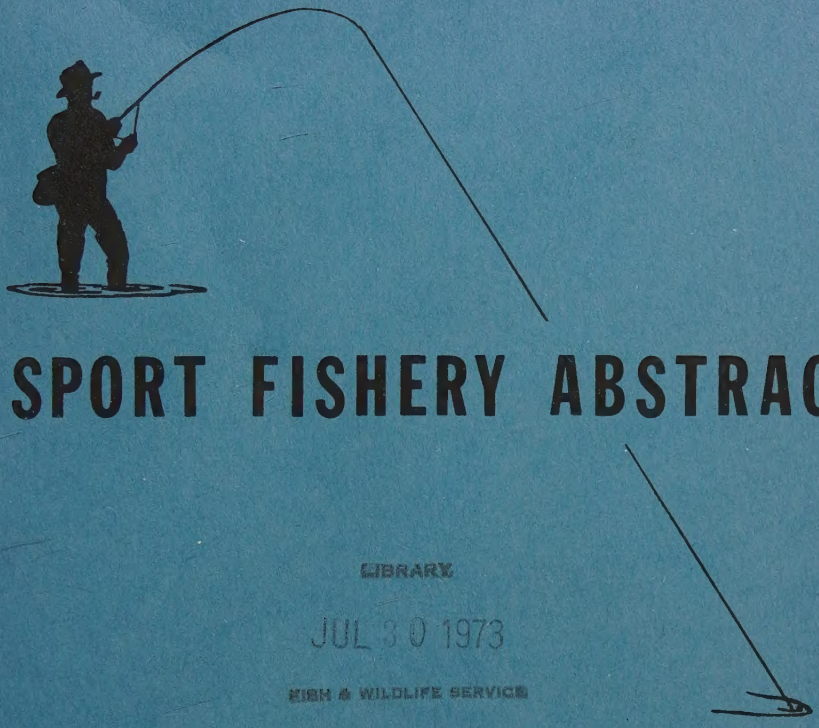

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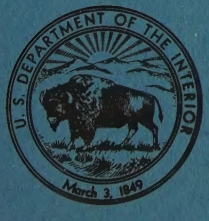

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Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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15985. Batts, Billy S. (Dept. of Nat. Science, Longwood College, Farmville, Virginia). 1972. AGE AND GROWTH OF THE SKIPJACK TUNA, Katsuwonus pelamis (Linnaeus), IN NORTH CAROLINA WATERS. Chesapeake Science, 13(4): 237-244.

Skipjack tuna, Katsuwonus pelamis, were collected from charter fishing boats operating from Hatteras and Oregon Inlet, North Carolina, from June-August for the years 1964-1965. Length-weight data were subdivided by year, area, and sex; and analysis of covariance indicated that one regression equation adequately described this relationship. Dorsal spine cross-sections were employed to assign absolute ages to the skipjack tuna. It was concluded that rings observed on the spine cross-sections were growth-marks, and that the growth-marks were annuli. Of 558 spine sections, 46 or 8.2% were unreadable. Back-calculated lengths were determined from spine radius measurements by direct proportion. At the end of the first year the average fish length was 406 mm, 2nd year - 493 mm, 3rd year - 569 mm, and 4th year - 638 mm. Asymptotic length and growth rate was estimated to be 872 mm (K = 0.154) and 784 mm (K = 0.195) for males and females. Mean lengths of fish of each age group were well separated; yet a great deal of overlap existed in the ranges. This was attributed to the relatively rapid-growing, short-lived fish. Length data were subdivided according to year, area, and sex. Analysis of variance of these data indicated a statistically significant difference between years and areas, but not between sexes. This was attributed to the differences in the age composition of the skipjack tuna collected at Hatteras and Oregon Inlet. (Auth.)

15986. Murai, Takashi, and James W. Andrews (Skidaway Inst. of Oceanography, 55 West Bluff Road, Savannah, Georgia 31406). 1972. GROWTH AND FOOD CONVERSION OF RAINBOW TROUT REARED IN BRACKISH AND FRESH WATER. NOAA Fishery Bull., 70(4): 1293-1295.

Rainbow trout were converted from fresh to 30‰ salinity in a period of 9 days and were reared to market size at this salinity. Trout fingerlings averaging 60 g each were reared to 266 g in 21°C fresh water with a rapid individual growth rate and an acceptable survival and food conversion rate. Survival and growth rates and food efficiencies were excellent for trout reared in brackish water at an average temperature of 13.5°C. (From authors' conclusions)

15987. Brown, Richard H., and Howard McCarley (Ouachita Baptist University, Arkadelphia, Arkansas). 1973. GROWTH RATES OF Lepomis macrochirus (CENTRARCHIDAE) IN THREE AREAS OF LAKE TEXOMA. The Southwestern Naturalist, 17(4): 371-374.

Growth rates of bluegills (Lepomis macrochirus) were determined for three areas of Lake Texoma: the Buncombe Creek area, the Island area, and the Denison Dam area. The total length of the Island bluegills for all age classes exceeded bluegills from both the Buncombe Creek and Denison Dam areas. The difference in total length of bluegills of the IV and V age classes from the Islands was significantly greater than for bluegills from the other two areas. Calculated growth rates of age groups IV and V also confirmed that bluegills in the Island area grew more during each year of life than bluegills in the other two areas. (Authors)

15988. Konefes, J. L., and R. W. Bachmann (Iowa State Univ., Ames, Iowa). 1970. GROWTH OF THE FATHEAD MINNOW (Pimephales promelas) IN TERTIARY TREATMENT PONDS. Proc. of Iowa Acad. of Sci., Vol. 77, pp. 104-111; Selected Water Resources Abstracts, 5(23): p. 69, 1972.

A series of experimental ponds, utilizing treated sewage effluent as a water source, have been constructed at the Ames Water Pollution Control Plant. Fathead minnow fry were introduced into the ponds in the summer of 1969 and observations were made on their growth rates, reproduction, and food habits during the summer months. Growth was comparable to that previously reported for hatchery ponds. The fish matured by mid-summer and successfully reproduced a second crop of fry. The use of tertiary ponds for fish production seems to be a useful approach to the conservation of natural resources.

15989. Hoyt, Robert D. (Biol. Dept., Western Kentucky Univ., Bowling Green, Kentucky). 1972. ANATOMY AND OSTEOLOGY OF THE CEPHALIC LATERAL-LINE SYSTEM OF THE SILVERJAW MINNOW, Ericymba buccata (PISCES: CYPRINIDAE). Copeia No. 4, 812-816.

The cephalic lateral-line system of the silverjaw minnow is similar to that of other cyprinids in that it includes the supraorbital, infraorbital, preoperculo-mandibular, and combined postocular commissure, supratemporal, and cephalic lateralis canals. All canals are paired and do not contact like canals on the opposite side of the head. The infraorbital and preoperculomandibular canals are unusual for American cyprinids in consisting of a series of greatly dilated pouches. Bones associated with each canal are described and illustrated. (Auth.)

15990. Li, Alexander H. H., and Eldon D. Warner (Zool. Research Bldg., Univ. of Wisconsin, Madison, Wisconsin 53706). 1972. THE PITUITARY GLAND OF THE ALEWIFE IN LAKE MICHIGAN: CYCLICAL CHANGES IN THREE ADENO-PHYPOPHYSEAL CELL TYPES. WIS-SG-72-329; NOAA Sea Grant 70's published by Texas A&M Univ. Sea Grant Program, College Sta., Texas, 3(4): p. 6.

Description of histology and cytology of the pituitary gland, and an account of cyclical variations in three adenophypophyseal cell types, gonadotrophs, thryo-trophs and corticatrophs, are included in this report.

15991. Dorson, M. (Lab. Ichtyopathol., Stn. Virol. et Immunol., INRA, 78-Thiverval-Grignon, France). 1972. THE IMMUNE RESPONSE IN RAINBOW TROUT (Salmo gairdneri): SOME CHARACTERISTICS OF THE IMMUNOGLOBULINS PRODUCED IN THE PRIMARY IMMUNE RESPONSE. (La reponse immunitaire chez la truite arc-en-ciel (Salmo gairdneri): quelques caracteristiques des immunoglobulines produites lors d'une reaction primaire.) Ann. Rech. Vet., 3(1): 93-107; Aquatic Sci. & Fish. Abs. Aq6525B; Fish Health News published by Eastern Fish Disease Lab., Kearneysville, West Va. 25430, 2(1): p. 10.

The primary immune response in rainbow trout has been studied with 2 antigens, a bacteriophage and a hapten coupled to a protein (2, 4-dinitro-phenyl-haemocyanin). Antibody activity was associated with 16S macroglobulins, and there was no shift to 7S antibodies after almost 5 months following immunization. The immunoglobulins were purified and partially characterized; the heavy chain of trout immunoglobulin was closely related to the μ chain of mammals.

15992. Blaxter, J. H. S. (Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland). 1972. BRIGHTNESS DISCRIMINATION IN LARVAE OF PLAICE AND SOLE. J. Experimental Biology, 57(3): 693-700.

The brightness discrimination of larvae of plaice and sole was tested by subjecting them to a choice of moving phototactically to one of two horizontally opposed light sources. At higher light levels, above 10^{0}-10^{-1}m-candles, they moved to the brighter of the two lights; below 10^{-1}-10^{-2} m-candles they moved to the dimmer. Brightness discrimination expressed as the increment (Δ I) discriminated as a percentage of the dimmer light (I) (the Weber fraction), was of the order of 60-200%. (Auth. summ.)

15993. Shelton, R. G. J., and K. W. Wilson (MAFF, Fisheries Lab., Lowestoft, Suffolk, England). 1973. EPIDERMAL LESIONS IN IRISH SEA FLATFISH. Nature, 241(5385): 140-141.

A survey of Irish Sea flatfishes was made in regard to incidence of lymphocystis, fin damage and ulcers, which have been hypothesized previously to be due to pollutants, particularly PCB's. Both lymphocystis and ulcers have been observed in Irish Sea flatfish for over 50 years, and it is commonly observed by both scientists and fishermen that the frequency of these infections undergoes cyclical fluctuations. Apart from any changes in the virulence of pathogens, these fluctuations are probably related to changes in salinity, water temperature and year-class strength and of all the environmental variables which can be invoked to explain these results, pollution is the least likely.

15994. Olla, Bori L., Carol E. Samet, and Anne L. Studholme (NMFS, Middle Atlantic Coastal Fisheries Center, Sandy Hook Lab., Highlands, New Jersey 07732). 1972. ACTIVITY AND FEEDING BEHAVIOR OF THE SUMMER FLOUNDER (Paralichthys dentatus) UNDER CONTROLLED LABORATORY CONDITIONS. NOAA Fishery Bulletin, 70(4): 1127-1136.

A group of five to six adult summer flounder, Paralichthys dentatus (Linnaeus), held under controlled laboratory conditions in a large, experimental, seawater tank, exhibited three general behavior patterns: (1) resting, (2) swimming, and (3) feeding. While resting on the sand surface, the fish maintained varying degrees of alertness, indicated by the position of the head and/or eye movements. Fish buried beneath the sand were considered to be in a lower state of responsiveness. The fish swam and glided at all levels in the water column or combined crawling and swimming to move along the sand. Activity measurements based on these swimming patterns indicated that the fish were primarily day-active. A range of feeding behaviors enabled the fish to capture prey equally well on the bottom or in the water column. The significance of these patterns and their relation to those of other flatfishes is discussed. (Authors)

15995. Pearson, J. Gareth, and F. Prescott Ward (Biomed. Lab., Edgewood Arsenal, Maryland). 1972. A NEW RECORD OF THE BOWFIN, Amia calva Linnaeus, IN THE UPPER CHESAPEAKE BAY. Chesapeake Science, 13(4):323-324.

Five adult bowfin, Amia calva Linnaeus, were gill-netted in the Gunpowder River estuary of the upper Chesapeake Bay in January, February, and March of 1972. These are the first records of this species in the area. Various counts and measurements of the specimens agreed with previous descriptions. The fish probably washed into tributaries of the Gunpowder River from stocked ponds that overflowed following extremely heavy rains on 1 August 1971. Approximately 600 to 700 adult bowfin apparently escaped. At least some of the fish were able to tolerate the estuarine conditions; however, only successful reproduction will determine whether or not the fish becomes established in the area. (Authors)

15996. Stein, Roy A., Paul E. Reimers, and James D. Hall (Dept. of Fish. & Wildl., Oregon State Univ., Corvallis, Oregon 97331). 1972. SOCIAL INTERACTION BETWEEN JUVENILE COHO (Oncorhynchus kisutch) AND FALL CHINOOK SALMON (O. tshawytscha) IN SIXES RIVER, OREGON. J. Fish. Res. Bd. Canada, 29(12): 1737-1748.

Spawning and emergence of coho and fall chinook salmon overlapped in timing and location in Sixes River, Oregon. In early spring both species were distributed throughout most of the river system. Underwater observations during this period indicated that both species occupied the same habitat. As temperatures increased, coho disappeared from the main river, but continued to occupy cool tributaries. Fall chinook were found primarily in the main river until early summer, when they moved to the estuary. In flowing-water observation troughs coho assumed social dominance and defended space near the source of incoming food. In allopatry in the troughs, both grew at similar rates, but coho maintained lower population densities than did chinook. Coho had brighter fin and body colors, greater fin development, deeper bodies, and were heavier than fall chinook of the same length. Our study suggests that the population of fall chinook salmon in Sixes River might be adversely affected by an increase in numbers of coho. Our evidence suggests that ecology of native fishes should be examined closely before widespread manipulation of fish stocks is encouraged. (Authors)

15997. Carey, Francis G. (Woods Hole Oceanogr. Inst., Woods Hole, Massachusetts). 1973. FISHES WITH WARM BODIES. Scientific American, 228(2): 36-44.

Not all fishes are cold-blooded. In some fast-swimming species of tuna and mackerel shark a rete mirabile of arteries and veins conserves the heat of metabolism to increase the power of the swimming muscles.

15998. Allen, John L., Charles W. Luhning, and Paul D. Harman (Southeastern Fish Control Lab., Bur. of Sport Fish. & Wildl., Warm Springs, Georgia 31830). 1972. RESIDUES OF MS-222 IN NORTHERN PIKE, MUSKELLUNGE, AND WALLEYE. U. S. Fish & Wildlife Service, Investigations in Fish Control No. 45, pp. 3-8.

Residues of MS-222 (tricaine methanesulfonate) in muscle tissue of northern pike, muskellunge, and walleye following anesthesia were measured by a modified Bratton-Marshall colorimetric method and confirmed by thin-layer chromatography. The residues dissipate rapidly from the muscle when fish are withdrawn from the anesthetic and are near the background readings of the controls within 24 hours. (Authors)

15999. Pieters, A. J., and F. G. DeBoer. 1971. DICHLOBENIL IN THE AQUATIC ENVIRONMENT. Proc. of the European Weed Res. Council 3rd Internatl. Symposium on Aquatic Weeds, Oxford 1971, pp. 183-93; Weed Abstracts, 21(2): p. 174, Abs. 1075.

Reviews the behaviour of dichlobenil in aquatic situations, including irrigation water, its residue levels in water, hydrosol and aquatic vegetation, its effect on water chemistry, toxicity to aquatic fauna, residue level in fish and effect on livestock when present in drinking water.

16000. Ellis, James E., and Charles C. Hoopes (NMFS, Fish Farming Development Center, P. O. Box 711, Rohwer, Arkansas 71666). 1972. A FRESHWATER FISH ELECTRO-MOTIVATOR (FFEM) - ITS CHARACTERISTICS AND OPERATION. NOAA Technical Report NMFS SSRF-660, 11 p., illus.

A prototype Freshwater Fish Electro-Motivator (FFEM) system was developed as a research tool to test the application of electricity for use with active and passive fishing gear for increasing the gear's catching efficiency. The system's basic characteristics and operating modes are explained. The prototype system is extremely sophisticated, and its versatility permits single or multiple time-sequenced electrode loading and various pulse patterns, and allows duty cycles over a wide dynamic electrode load range. A summary of the field testing is discussed. (Authors)

16001. Demski, Leo S., and Lawrence F. Picker (Dept. of Anim. Behavior, The American Museum of Nat. Hist., New York, N. Y.). 1973. A MOVEABLE ELECTRODE FOR BRAIN STIMULATION IN FISHES. Comp. Biochem. Physiol., 44(2A): 457-460.

A simple, inexpensive moveable electrode for brain stimulation in fishes is described. The apparatus is lightweight and may also be used with other small aquatic animals. Details of construction, implantation and usage are given. (Authors)

16002. Tindle, Roger C., and David L. Stalling (Fish-Pesticide Res. Lab., Columbia, Missouri 65201). 1972. APPARATUS FOR AUTOMATED GEL PERMEATION CLEANUP FOR PESTICIDE RESIDUE ANALYSIS. APPLICATIONS TO FISH LIPIDS. Analytical Chemistry, 44(11): 1768-1773; Comm. Fish. Abstr., 26(2): p. 1, 1973.

In the analysis of sample extracts for pesticide residues, separation of lipids is often time consuming. Automating analyses for pesticides would improve precision, decrease sample losses, and save labor. The basic analytical technique, however, must be amenable to automation. Previously, the authors reported a gel permeation cleanup procedure for separation of pesticides from lipids in sample extracts (J. Assn. Offic. Anal. Chem. 55, 32-38 (1972)). Because of the long elution time required by the procedure the authors believe that it is not entirely practical for manual operation. The procedure lends itself to automation, in the authors' view. In this article, the authors describe an automated gel permeation chromatography system which consists of a solvent source and pump, a manual loading valve, a remotely controllable sample introduction system, a chromatography column, and a remotely controllable sample collection system. The system

is capable of either manual or automatic control of sample introduction and sample collection. An external digital controller allows automatic unattended operation of the system for periods up to 24 hr. The procedure was found to be extremely reproducible provided limits of lipid concentration and flow rates of the original (manual) procedure are observed. Cross contamination of samples was negligible. Simulated sample extracts were prepared in cyclohexane to determine recoveries and precision. Each 5 ml. sample contained 250 mg. of corn oil in addition to mixtures of pesticides. Concentrations of lipid and pesticide simulated those frequently encountered in actual extracts of whole ground fish where 1 ml. of sample represents 1 g. of fish. Aliquots of a prepared solution were independently processed in the automated system. The small values for the standard errors (0.02 to 0.06) and coefficients of variation (2.2 to 3.6%) indicate that the system gave reproducible results. Any technique that uses only one solvent throughout sample addition and elution could be adapted to this system without significant modification. A flow diagram and an electrical schematic of the system are included.

16003. Hunter, C. J., and C. O. Wheeler (NMFS, Northwest Fisheries Center, Seattle, Washington 98112). 1972. DEVICE FOR MEASURING LENGTH AND GIRTH OF FISH. J. Fish. Res. Bd. Canada, 29(12): 1784-1785, illus.

Continued improvement in fish-measuring devices is necessary in fishery science. A length and girth measuring device was developed that will make multiple measurements rapidly on live fish with accuracies to 1 mm. Construction plans are available. (Authors)

16004. Yu, T. C., and R. O. Sinnhuber (Dept. of Food Sci. and Technology, Oregon State Univ., Corvallis, Oregon 97331). 1972. EFFECT OF DIETARY LINOLENIC ACID AND DOCOSAHEXAENOIC ACID ON GROWTH AND FATTY ACID COMPOSITION OF RAINBOW TROUT (Salmo gairdneri). Lipids, 7(7): 450-454; Sea Grant 70's published by Texas A&M Univ. Sea Grant Program, College Sta., Texas, 3(4): p. 7.

Methyl linolenate 18:3ω3 and docosahexaenoate 22:6ω3 were incorporated in semipurified diets at several levels and fed to trout previously maintained on a fat-free diet. After 14 weeks, the weight gain and feed conversion of the fish on each diet were determined. Fatty acid composition of the lipid from each group of fish was analyzed by gas liquid chromatography. Both 18:3ω3 and 22:6ω3 fed at the 1% level supported maximum growth of the fish.

16005. Opuszynski, Karol (Inland Fisheries Inst., Zabieniec near Warsaw, p-ta Piaseczno, Poland). 1969. REARING OF HERBIVOROUS FISH (Ctenopharyngodon idella AND Hypophthalmichthys molitrix Val.) IN CARP PONDS. Roczn. Nauk roln. (Ser. H), 91(2): 219-309; Weed Abstracts, 21(3): p. 218, Abs. 1324, 1972.

A section on the control of aquatic vegetation with grass carp (C. idella) is included. The main diet of grass carp > 3-4 cm long is rooted plants and, in polycultures, they eat only a little of the food (sorghum) provided for common carp (Cyprinus carpio). Silver carp (H. molitrix) feed on zooplankton and phytoplankton (especially Chlorophyta spp.) but older fish consume mainly phytoplankton. The stocking of 3-year-old grass and silver carp, each at 600 fish/ha, in addition to common carp at 1200 fish/ha, increases the total fish production of ponds by about 25%.

16006. Bullis, Harvey R., Jr., Richard B. Roe, and Judith C. Gatlin (NMFS, Southeast Fisheries Center, Miami, Florida 33149). 1972. THE SOUTHEAST FISHERIES CENTER BIONUMERIC CODE. PART I: FISHES. NOAA Technical Report NMFS SSRF-659, 95 p.

The Southeast Fisheries Center, Pascagoula, Mississippi Laboratory uses a nine-digit numeric code to catalog marine organisms. The basic code was adapted from the FAO taxonomic code developed in 1960, to which generic and specific levels were added and considerable classification modifications adopted. This publication provides the code listing for fishes. Succeeding publications will deal with such groups as crustacea, mollusca, and various invertebrates. (Authors)

16007. Laarman, Percy W., and James C. Schneider. 1972. THE FOOD AND FEEDING HABITS OF THE BLUEGILL AND YELLOW PERCH IN LAKES WITH GOOD AND POOR FISHING. Mich. Dept. of Natural Resources Research and Development Report No. 279, 29 p.

Growth and feeding habits of bluegills and perch were compared between two lakes with good fishing and two lakes with poor fishing. Also compared were the populations of benthos and zooplankton. For these studies, samples were collected during the second week of July and the second week of September 1971. Fish had faster growth and reached a larger size in the good lakes. The good lakes were more productive in terms of standing crop of benthos and plankton. Presence or absence of any one species of invertebrate would not serve as a reliable index of fishing quality; however, Daphnia, Chironomus and Hexagenia populations were larger in the good lakes. The average size of Daphnia was also larger in the good lakes. These data suggest that, in general, September standing crops of 15 mg/m^3 dry weight of Cladocera and 1.1 kg/ha dry weight of chironomids may be necessary to maintain a desirable panfish population. Bluegills ate a variety of foods including large amounts of terrestrial insects. There were no consistent differences in food habits of bluegills of different sizes (range 50-244 mm) and no large differences between good lakes and poor lakes in either type or quantity of food eaten. Small differences which were noted in July sampling were the higher amounts and larger size of Daphnia in the diet of bluegills in the good lakes. Bluegills in poor lakes, on the other hand, contained more plant material than did bluegills in the good lakes. Perch also ate a wide variety of foods. In contrast to the bluegill, there were more significant differences among perch of various sizes and among lakes. Small perch, 50-124 mm long, ate most snails, mayflies and amphipods. Perch 125-175 mm long included crayfish and fish in their diet. Dragonflies and mayflies (especially Hexagenia) were a larger part of the diet of perch in good lakes than poor lakes. Perch larger than 175 mm collected from the good lakes fed heavily on Leptodora, Daphnia, chironomids and crayfish. The few perch of this size (i.e., over 175 mm) collected from a poor lake were feeding on fish, crayfish and snails. Comparison of the species and size composition of plankton taken in nets to that in perch stomachs suggests that perch were selecting Leptodora and large Daphnia. Of the Daphnia eaten, 63% were over 1.3 mm in length. Total amount of food in perch stomachs did not differ significantly between good and poor lakes and was not correlated with growth. (Authors summ.)

16008. Gerke, Robert J., and Victor W. Kaczynski (Washington Dept. of Fish., Olympia, Washington). 1972. FOOD OF JUVENILE PINK AND CHUM SALMON IN PUGET SOUND, WASHINGTON. Wash. Dept. of Fish., Technical Report No. 10, 27 p.

Pink and chum salmon (Oncorhynchus gorbuscha and O. keta) were collected from three widely separated onshore areas of Puget Sound during April, May, and early June 1970 to ascertain the kinds and types of organisms in the diet. Sampling areas included: (1) Anderson Island (southern Puget Sound), (2) Port Susan (central Puget Sound), and (3) Toandos Peninsula (Hood Canal). Fish collected from the Anderson Island area fed almost exclusively on harpacticoid copepods (95% of the stomach contents). Food items consumed at the other sampling sites indicated a more variable diet as gammarid amphipods, barnacle nauplii, euphausids, harpacticoid copepods, and eggs of invertebrate animals were important in the diet. Epibenthic forms were the predominant food type throughout the sampling period at Anderson Island and during the month of May at the other areas. Interspecific differences in the kinds of organisms consumed were uncommon. The distinct ecological zone that epibenthic forms inhabit makes them extremely susceptible to changes in the beach habitat brought about by domestic and industrial development of intertidal and subtidal areas. (Authors)

16009. Weihs, D. (Dept. of Applied Math. and Theor. Physics, Univ. of Cambridge, Cambridge, England). 1973. HYDROMECHANICS OF FISH SCHOOLING. Nature, 241(5387): 290-291.

16010. Darlington, Robert W., Rebecca Trafford, and Ken Wolf (Authors' address: Dr. K. Wolf, Director, U. S. Dept. of the Interior, Eastern Fish Disease Lab., Leetown, Route 1, Box 17, Kearneysville, West Virginia 25430). 1972. FISH RHABDOVIRUSES: MORPHOLOGY AND ULTRASTRUCTURE OF NORTH AMERICAN SALMONID ISOLATES. Archiv für die gesamte Virusforschung 39, 257-264.

The morphology and ultrastructure of three North American salmonid pathogens, Oregon sockeye salmon, chinook salmon and infectious hematopoietic necrosis viruses, were examined by thin sectioning and negative staining after growth in fathead minnow cells at 10°C. The viruses matured at the plasma membrane of these cells. They were approximately 170 nm in length, 70 nm in width and had internal striations with a periodicity of 5.5 nm. They were rounded on one end and planar on the other (i.e., bullet shaped). By morphological criteria, these viruses are rhabdoviruses with dimensions and ultrastructural features similar to vesicular stomatitis virus. (Authors' summ.)

16011. Sharp, Gary D. (Inter-Am. Tropical Tuna Comm., c/o Scripps Inst. of Oceanography, La Jolla, California). 1973. AN ELECTROPHORETIC STUDY OF HEMOGLOBINS OF SOME SCOMBROID FISHES AND RELATED FORMS. Comp. Biochem. Physiol., 44(2B): 381-388.

The electrophoretic characteristics of the hemoglobins of thirty-one species of marine fish are presented. The importance of chemical stabilization of the hemoglobins just prior to electrophoresis is discussed. Comparative analyses of the various groups is made and the similarities and electrophoretic identities of several species are shown. The occurrence of multiple hemoglobins seems to be the rule rather than the exception as only three closely related species were found to exhibit only one hemoglobin. Thunnus alalunga is the only species observed to have extensive polymorphism, though no attempt to explain the genetic basis has been made as yet. (Auth.)

16012. Schubel, J. R., and E. W. Schiemer (Chesapeake Bay Inst., The Johns Hopkins Univ., Baltimore, Maryland 21218). 1972. THE ORIGIN OF ACOUSTICALLY TURBID SEDIMENTS IN CHESAPEAKE BAY. Chesapeake Bay Inst., The Johns Hopkins Univ. Special Report 23, Ref. 72-5, 21 p.

Many shallow water, fine-grained sediments are almost acoustically impenetrable to the energy from high resolution, low energy continuous seismic profilers. It has been alleged that their anomalous acoustic behavior is the result of interstitial gas bubbles that produce reverberation within the sediment, but no analyses were made until recently to test this hypothesis. Determinations of the compressibility of sediments from acoustically impenetrable zones and from contiguous zones of good penetration in Chesapeake Bay showed that the acoustically turbid sediments are several orders of magnitude more compressible than acoustically clear sediments of very similar grain size. The increased compressibility is a result of the presence of interstitial gas bubbles. Other acoustically turbid zones are produced by buried shell beds, and do not show an increase in compressibility. (Authors)

16013. Boehlke, K. W., R. L. Church, O. W. Tiemeier, and B. E. Eleftheriou (Dept. of Zool., Kansas State Univ., Manhattan, Kansas). 1966. DIURNAL RHYTHM IN PLASMA GLUCOCORTICOID LEVELS IN CHANNEL CATFISH (Ictalurus punctatus). Reprint: General and Comparative Endocrinology, 7(1): 18-21.

Plasma and head kidney glucocorticoids were identified in the channel catfish (Ictalurus punctatus), and plasma levels were quantitatively determined at midnight, 6 AM, 10 AM, 2 PM and 7 PM. Cortisone, corticosterone, and cortisol were found in a ratio of 15:7:2. Cortisone rose significantly at 6 AM and at 2 PM, whereas corticosterone significantly increased at midnight, 7 PM and at 10 AM. Cortisol showed no diurnal variation. However, total glucocorticoid level rose significantly at 2 PM only. (Authors)

16014. McDowall, R. M. (Fish. Res. Div., Marine Dept., Wellington, New Zealand). 1972. THE SPECIES PROBLEM IN FRESHWATER FISHES AND THE TAXONOMY OF DIADROMOUS AND LACUSTRINE POPULATIONS OF Galaxias maculatus (Jenyns). Journal of the Royal Society of New Zealand, 2(3): 325-367.

The species problem in freshwater fishes, in which allopatry is the norm, is discussed. Biological species criteria break down because of the general occurrence of allopatry, and the implications for the taxonomy of freshwater fishes are explored. Essentially morphological criteria must be used, but their use must be subject to careful scrutiny, and patterns of variation must be studied. Galaxias maculatus (Jenyns) is shown to occur in Australia, New Zealand, Chatham Islands, Chile, Tierra del Fuego, and Falkland Islands in the typical diadromous form. Subspecies are not recognized. Landlocked or freshwater-limited populations occur through much of the range of the species, and in these populations vertebral number is reduced to about 55, from about 62 in diadromous stocks. These populations are not given separate taxonomic recognition, variation in vertebral number being regarded as related to the transition from a diadromous to a wholly freshwater life history; G. usitatus McDowall and G. parrishi Stokell become synonyms of G. maculatus. Further populations in small lakes in North Auckland, New Zealand, have only about 49 vertebrae. These are regarded as specifically distinct and are placed in G. gracilis McDowall. (Auth.)

16015. Ware, Forrest J., Wesley V. Fish, and Louie Prevatt (Game and Fresh Water Fish Comm., So. Fla. Region Office, 2202 Lakeland Hills Blvd., Lakeland, Florida 33801). 1972. FIVE-YEAR CREEL SURVEY OF TWO FLORIDA LAKES. Quart. Jour. Florida Acad. Sci., 35(1): 31-48.

Although lakes Griffin and Harris are located within the same watershed and adjacent to the same populous area, the creel survey has shown their fisheries to be of distinctly separate qualities. Sport fishing on Lake Griffin has been largely supported by panfishes; black crappie during the winter months, and bluegill and redear in the late spring and summer. The fishery for largemouth bass has declined steadily since the study began. Bass fishing is now considered to be relatively poor. Fishing pressure and yields per acre were higher on Lake Griffin. Conversely, the Lake Harris fishery has shown a better catch distribution among available game fishes. Largemouth bass were chiefly responsible for the difference, providing a substantial portion of the annual yield for each creel year. Bass also attracted a major segment of the fishing pressure, which was probably related to the relatively good catch rate. The fishery for panfish showed a trend of general improvement during the study period. Bluegill and redear comprised the greatest portion of the catch, although black crappie yields were of significant importance, especially during winter months. (From authors' discussion and summ.)

16016. Gyurko, S., and Z. I. Nagy (Babes-Bolyai Univ., Cluj (Rumania). 1971. ASPECTS OF THE NUTRITIVE DYNAMICS AND TROPHIC RELATIONSHIPS OF THE BURBOT (Lota lota lota L.) IN THE UPPER MURES RIVER (IN RUMANIA). Stud Cercet Biol Ser Zool., 23(4): 367-376, illus, English summ.; Selected Water Resources Abstracts, 5(23): p. 13.

The qualitative and quantitative composition of the food of L. lota lota is presented in relation to season, year class and body length. Data analysis indicate that the burbot may be safely used to stock some of the Romanian lakes. -- Copyright 1972, Biological Abstracts, Inc.

16017. Scalet, Charles G. (Dept. of Zool., Univ. of Okla., Norman, Oklahoma). 1973. STREAM MOVEMENTS AND POPULATION DENSITY OF THE ORANGEBELLY DARTER, Etheostoma radiosum cyanorum (OSTEICHTHYES: PERCIDAE). The Southwestern Naturalist, 17(4): 381-387.

The orangebelly darter, Etheostoma radiosum cyanorum, is found only in the Blue River system of south central Oklahoma. Adult fish exhibited very little movement within the stream. It was found that few of the adults showed intra-raceway movement and none exhibited inter-raceway movement. Larval and young-of-year darters exhibited stream movement. Postlarval fish were found in the quiet water

or pool areas of the stream. As the fish increased in size they moved into progressively swifter water. At approximately 25 mm total length they were found in the raceway areas of the stream, their adult habitat. Approximately 2.66 adult orangebelly darters were found for every square meter of raceway in the study area. (Auth.)

16018. Kendall, Arthur W., Jr. (NMFS, Middle Atlantic Coastal Fish. Center, Sandy Hook Lab., Highland, New Jersey 07732). 1972. DESCRIPTION OF BLACK SEA BASS, Centropristis striata (Linnaeus), LARVAE AND THEIR OCCURRENCES NORTH OF CAPE LOOKOUT, NORTH CAROLINA, IN 1966. NOAA Fishery Bulletin, 70(4): 1243-1259.

Larvae of black sea bass collected during RV Dolphin ichthyoplankton surveys of the mid-Atlantic continental shelf are described. Development of most meristic characters occurs between 6 and 10 mm standard length. The larvae are identified by characteristic ventral pigment patterns, body shape, meristic counts, and lack of extensive armature. The 147 larvae were taken during cruises from June to November 1966, from 4 to 82 km from shore. They were found in tows from the surface to 33 m in water varying in surface temperature from 14.3° to 28.0°C and surface salinity from 30.3 to 34.6‰. (Auth.)

16019. Lindsey, C. C., and W. G. Franzin (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1972. NEW COMPLEXITIES IN ZOOGEOGRAPHY AND TAXONOMY OF THE PYGMY WHITEFISH (Prosopium coulteri). J. Fish. Res. Bd. Canada, 29(12): 1772-1775.

Pygmy whitefish (Prosopium coulteri) are recorded for the first time from the Peel-Mackenzie river drainage (Elliott Lake, Yukon Territory) and from the Hudson Bay drainage (Waterton Lakes, Alberta, in the South Saskatchewan-Nelson river system). The morphology of specimens from both localities contradicts the previously known pattern of a southeastern "low-rakered" and a northwestern "high-rakered" form (with the two forms occurring sympatrically in some lakes of the Bristol Bay area). Specimens from Elliott Lake, the most northerly known locality, resemble the southeastern form and those from Waterton Lakes the northwestern form. Both Waterton and Elliott lakes lie close to unglaciated refugia, suggesting that the species may have survived Wisconsin glaciation and diverged in several different watersheds. (Authors)

16020. Fast, Arlo W., and Walter T. Momot (Dept. of Fish. & Wildl., Mich. State Univ., East Lansing, Michigan). 1973. THE EFFECTS OF ARTIFICIAL AERATION ON THE DEPTH DISTRIBUTION OF THE CRAYFISH Orconectes virilis (Hagen) IN TWO MICHIGAN LAKES. The American Midland Naturalist, 89(1): 89-102.

Crayfish (Orconectes virilis) usually exhibit seasonal depth distributions in certain northern Michigan lakes based on sex, age and water temperature. After releasing attached young in shallow water, the adult females typically migrate to deeper cold water while the adult males remain in the warm shallow water. This pattern was thought to be related to the sexual maturation cycle. However, when two lakes were artificially aerated and destratified with compressed air, both sexes distributed throughout the lakes. It is, therefore, postulated that under normal conditions of thermal stratification, the social aggression of the larger males forces the females into deeper, colder water and that this aggression is temperature-related. If oxygen or some other factor is not limiting, 10C seems to be the lowest temperature selected by O. virilis during the summer. (Authors)

16021. Menshutkin, V. V., and A. A. Umnov (Inst. of Evol. Physiol. and Biochem., USSR Academy of Science, Leningrad, USSR). 1971. ENERGY MODEL OF THE PELAGIC ECOSYSTEM OF LAKE DAL'NEYE. Hydrobiological Journal, 7(4): 7-11.

The functional model of the ecosystem in the pelagic area of Lake Dal'neye was converted to an energy model, which gave satisfactory agreement with the modeled system in terms of mean annual values of biomass and production of all the elements of the ecosystem. This proves the correctness of the theoretical premises used to derive the model.

16022. Mayer, Foster L., Jr., David L. Stalling, and James L. Johnson (Fish-Pesticide Res. Lab., Bur of Sport Fish. & Wildl., Columbia, Missouri 65201). 1972. PHTHALATE ESTERS AS ENVIRONMENTAL CONTAMINANTS. Reprint from Nature, 238(5364): 411-413.

The acute toxicity of phthalate esters seems relatively insignificant, but there are indications that these compounds can be detrimental to aquatic organisms at low chronic concentrations. They are produced in large amounts, they are in wide use as plasticizers, and, by some means, they are entering aquatic ecosystems. Thus, these compounds should be considered as environmental pollutants and a more detailed evaluation of toxicological effects of phthalate esters is essential to elucidate their impact on these systems.

16023. Takashima, Fumio, and Takashi Hibiya (Lab. of Fish-Culture, Fac. of Fish., Tokyo Univ. of Fish., Tokyo, Japan). 1972. FIBROSARCOMA IN POND-CULTURED HYBRIDS OF Salvelinus. Jap. J. Ichthyol., 19(2): 97-102. In English.

In the first filial generation of the Salvelinus miyabei X S. fontinalis hybrids, neoplasms on the skin surface were observed. The tumors were composed of atypical spindle cells producing collagenous fibers. The tumor cells invaded the tella subcutanea and trunk muscles. Metastases occurred in the kidney. The tumors grew rapidly, concomitant with gonadal development. One fish with the largest tumor died shortly after spawning. On the basis of these findings the tumors have been classified as dermal fibrosarcomas. Similar neoplasms developed in S. miyabei, but not in S. fontinalis. The circumstances suggest that genesis of these tumors is hormonally and genetically influenced. (Authors)

16024. Särkkä, Jukka (Dept. of Biol., Univ. of Jyväskylä, Finland). 1972. THE BOTTOM MACROFAUNA OF THE OLIGOTROPHIC LAKE KONNEVESI, FINLAND. Annales Zoologici Fennici, 9(3): 141-146.

The abundance of the bottom fauna of this lake is lowest around the thermocline and in the greatest depths (>35 m). The dominant species of the profundal zone is Pisidium conventus, and larvae of Chironomids dominate in the sublittoral. The abundances of the dominant species, the total numbers of individuals and the biomasses were practically the same in the different parts of the lake. The glacial relicts Gammaracanthus lacustris, Pallasea quadrispinosa, Pontoporeia affinis, and Mysis relicta are new records for Lake Konnevesi. Diversity indices were calculated to compare the different sub-areas. The values of these indices and the factors affecting them are discussed. It is suggested that the low abundances observed for the greatest depths are chiefly due to the low oxygen content in winter. It is difficult to classify this lake on the basis of its bottom fauna into any one of the conventional limnological lake types. (Auth.)

16025. Tollefson, Thor C. 1972. A SALMON ANGLING PROGRAM FOR THE PUGET SOUND REGION. State of Washington, Dept. of Fisheries Information Booklet No. 2, 29 p.

The 13-point Puget Sound sport fishery enhancement plan as presented by Director Tollefson in a speech to the Northwest Steelheader's Chapter of Trout Unlimited, July 1971: Resident coho; Earlier-running, better-biting coho; Refine methods of producing resident coho; Rivers Inlet chinook fall hybrids; Spring chinook; Summer chinook; Resident pinks (humpies); Biting parents for biting progeny; Promoting a greater sport catch by modifying angler regulations; Baitfish; Fish-finder boat; Caponization; Minimizing sport-net competition.

16026. Cornell, J. H. 1970. IMPACT OF RESERVOIR OPERATIONS ON FISH POPULATIONS. In: Proc. 19th Southern Water Resources and Pollution Control Conf., April 9-10, 1970, held at Dept. of Civil Engineering, Duke Univ., Durham, No. Carolina, p. 28-36; Univ. of Wis. Water Resources Center Eutrophication Program, No. 32, No. 4363, p. 6.

Ten illustrations are given demonstrating North Carolina situations where reservoir operation impact results in a major effect on fish populations. Consequences of construction procedures, stratified flows within the reservoirs, water level fluctuations, organic loading, the passage of migratory species, and the release of downstream flows are considered.

16027. St. Pierre, Richard A., and Jackson Davis (Va. Inst. of Mar. Sci., Gloucester Point, Virginia). 1972. AGE, GROWTH AND MORTALITY OF THE WHITE PERCH, Morone americana, IN THE JAMES AND YORK RIVERS, VIRGINIA. Chesapeake Science, 13(4): 272-281.

More than 800 white perch, Morone americana, were collected from each of two major tributaries of southern Chesapeake Bay to compare age structures, growth and mortality rates. The James River is characterized by heavy domestic and industrial pollution in several tributaries and segments, whereas the York River is only slightly polluted. Maximum ages determined by scale analysis were 7 and 10 years for males and females in both rivers. Yearling perch in the York River appeared to have a significantly greater mean length than those from the James but this difference is largely due to sampling bias. Both sexes of white perch from the James River were significantly larger than perch from the York River at ages II and III. However mean lengths of white perch from age groups IV and older were not significantly different between rivers for either sex. In both rivers females were significantly longer (to age V) and heavier (all ages) than males of comparable age. Yearly growth increments were greatest early in life. All year classes of white perch followed a similar growth pattern during their first year in both estuaries. However for later years of life earlier year classes apparently had a greater mean length than those from more recent years at comparable ages. Males were more abundant than females for the first 3 years of life in both rivers, however, females were present in significantly greater numbers in all older age groups. Analysis of relative age frequency suggested dominant year classes in 1964 and 1965 in the James River, and a weak year class in 1968. No dominant year classes were apparent from the York River collections. Mortality rates were calculated from age frequency distributions. Total annual mortality in the James River was about 69% for males after age IV and for females after age VI. In the York River, males at age III and older die at a rate of 59%, whereas females older than age V have an annual mortality of 57%. (Authors)

16028. Fischer, Z. (Polish Acad. of Sciences, Warsaw Inst. of Experimental Biology, Warsaw, Poland). 1970. THE ELEMENTS OF ENERGY BALANCE IN GRASS CARP (Ctenopharyngodon idella Val.): I. Pol. Arch. Hydrobiol., 17(4): 421-434, illus.; Selected Water Resources Abstracts, 5(23): p. 14.

Energy changes were investigated in grass carp bred on plant food. The 02 consumption, excretion of CO12 and N, value of food ration and the basic energy indicators K1 and K2 and also U-12 were determined. -- Copyright 1972, Biological Abstracts, Inc.

16029. Schneider, James C. 1972. DYNAMICS OF YELLOW PERCH IN SINGLE-SPECIES LAKES. Michigan Dept. of Natural Resources Research and Development Report No. 184, 47 p.

Experimental populations of yellow perch were established in Cassidy and Jewett lakes after the existing fish populations of these lakes were eliminated. Abundance, growth, recruitment and mortality of the perch were followed for several years. Additional observations were made on food habits, fecundity and spawning of perch, and on the plankton and benthos of the lakes. An extremely large year class of perch was produced in each lake. Members of the class stopped growing at a length of 4-5 inches because they had depleted the supply of benthic food organisms. The large year classes dominated the populations, by number and weight, and prevented recruitment of subsequent year classes. As a result, few perch grew to a large size and angling, if it had been permitted, would have been of unsatisfactory quality. A mathematical model was developed which showed that recruitment of both small- and medium-sized perch would have to be controlled by predation (by another species of fish or by man) to optimize the number of large perch in the population and the yield to anglers. (Auth.)

16030. Marvin, K. T., R. S. Wheeler, and L. M. Lansford (NMFS, Biol. Lab., Galveston, Texas). 1972. A DEVICE FOR RELEASING FEED AT SCHEDULED INTERVALS. Chesapeake Science, 13(4): 327-328.

16031. Bayless, Jack D. 1972. ARTIFICIAL PROPAGATION AND HYBRIDIZATION OF STRIPED BASS, Morone saxatilis (Walbaum). So. Carolina Wildlife and Marine Resources Dept., 135 p. + xiii app., illus.

Detailed descriptions of hatchery procedures for striped bass, Morone saxatilis (Walbaum) with emphasis on handling of brood fish, procurement of viable eggs, care of eggs and larvae and design of hatchery facilities are given. Photographs illustrating the ripening process of striped bass eggs, white bass eggs and eggs from F_1 hybrids (striped bass female x white bass male) are presented. Also, pictorial depiction of striped bass, white bass and hybrid egg development from fertilization to hatching is given along with similar portrayal for each variety of larvae. Results of various attempts at back-crossing, reciprocal crosses and production of second-generation hybrids, along with descriptions of meristic characters for each are presented. (Auth.)

16032. Waldron, Kenneth D. (NMFS, Northwest Fish. Center, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. FISH LARVAE COLLECTED FROM THE NORTHEASTERN PACIFIC OCEAN AND PUGET SOUND DURING APRIL AND MAY 1967. NOAA Technical Report NMFS SSRF-663, 16 p.

Fish larvae belonging to 24 families and the suborder Blennioidea were collected from Puget Sound and the Pacific Ocean off British Columbia, Washington, and Oregon during April and May 1967. All families and the Blennioidea were present in oceanic waters, but only 13 families and the Blennioidea were present in Puget Sound. The most abundant families in the oceanic area were Scorpaenidae, Myctophidae, and Pleuronectidae, whereas in Puget Sound the most abundant families were Gadidae, Pleuronectidae, and Scorpaenidae. Variations in composition and numbers of larvae in the catch were associated with area, water depth, water temperature, and time of day at which the collections were made. (Auth.)

16033. Smith, C. L. (Dept. of Zool., Univ. of Liverpool, Liverpool, England). 1973. THERMOSTABILITY OF SOME MITOCHONDRIAL ENZYMES OF LOWER VERTEBRATES - II. FRESH-WATER TELEOSTS. Comp. Biochem. Physiol., 44(3B): 789-801.

The thermostability of succinoxidase, malate dehydrogenase, NADH dehydrogenase and cytochrome oxidase enzyme systems in liver mitochondria isolated from fourteen species of fresh-water teleosts was determined by a standard procedure. These systems showed great differences in stability in any one species and the possibility is discussed that this reflects a shift in emphasis on particular metabolic pathways when the environmental temperature changes. Overall thermostability of these respiratory enzyme systems is not obviously correlated with the phylogenetic history of the species but does in most cases correspond to the thermal environment to which the species is adapted. (Auth.)

16034. Solomon, D. J., and A. E. Brafield (Dept. of Biol., Queen Elizabeth College, Univ. of London, England). 1972. THE ENERGETICS OF FEEDING, METABOLISM AND GROWTH OF PERCH (Perca fluviatilis L.). J. Anim. Ecol., 41(3): 699-718.

This paper describes a laboratory investigation of the energy relationships of feeding, metabolism and growth of a carnivorous freshwater fish, Perca fluviatilis, fed on Gammarus pulex. Energy budgets for 28-day periods are presented for fish of different sizes and feeding regimes. Generally the agreement between energy measured as ingoing and outgoing was good; where the balance was not good, the only possible explanation appears to be a change in the calorific value of the fish. Maintenance coefficients (energy required per g of fish per year to maintain weight) fall within the range for other freshwater fish, and vary indirectly with the size of fish. The results are compared with those of other workers of freshwater fish and with Winberg's (1956) predictions of metabolism. It is suggested that a more accurate estimate of metabolic rate would take account of feeding. The results of these experiments, the first in which all categories of energy flow have been continuously measured in a growing fish, indicate that the majority of the assumptions often made in energy studies are valid. (Authors' summ.)

16035. Weinberg, Sheila R., Charles D. Siegel, Ross F. Nigrelli, and Albert S. Gordon (Dept. of Biol., Grad. School of A. & S., New York Univ., New York, N. Y.). 1972. THE HEMATOLOGICAL PARAMETERS AND BLOOD CELL MORPHOLOGY OF THE BROWN BULLHEAD CATFISH, Ictalurus nebulosus (Le Sueur). Zoologica, 57(2): 71-78.

The present research indicates that the various procedures utilized in the study of the hematopoietic systems of the higher classes of the vertebrates are applicable, with some modifications, for the study of the hematology of the poikilotherms. A description is presented of the peripheral blood cell constituents, with an emphasis on the distinction of the various stages of development of the erythrocytic and leucocytic series, reflected by: changes in the nuclear chromatin, location, size and shape of the nucleus, size and shape of the cell, and the state of cytoplasmic basophilia. One of the aims of this study was to examine some aspects of the erythrocytic system in the normal, bled, and mechanically stressed bullhead catfish. Values were determined for red cell, white cell, reticulocyte, differentials, hematocrit, hemoglobin, and the erythrocyte corpuscular constants. Statistical analyses indicate a significant difference in the red blood cell count, white blood cell count, reticulocyte count, and mean corpuscular volume after bleeding. The evidence supports the view that there is a physiological control, possibly hormonal in nature, responsible for blood cell formation in different species of fish. (Authors)

16036. Schenkel-Brunner, H., H. Splechtna, and H. Kothbauer (Inst. für Biochem. der Univ. Wien, Vienna, Austria). 1972. ON THE PRESENCE OF HEMAGGLUTININS (ANTI-H AND ANTI-B) IN THE EUROPEAN PERCH (Perca fluviatilis) [Über das Vorkommen von Hämagglutinen (Anti-H and Anti-B) beim Flussbarsch (Perca fluviatilis)]. Experientia, 28(12): p. 1479. In German with English summ.

Perches (Perca fluviatilis) were dissected and the parts tested for agglutinin activity. Only in the female gonads a very strong anti-H could be found. Its strength is certainly subjected to seasonal variations. Anti-B was found in the blood. There is obviously no connection between the anti-H in the female gonads and the anti-B out of the blood. (Authors' summ.)

16037. Eldridge, Maxwell B., and Charles F. Bryan (NMFS, Tiburon Fish. Lab., Tiburon, California 94920). 1972. LARVAL FISH SURVEY OF HUMBOLDT BAY, CALIFORNIA. NOAA Technical Report NMFS SSRF-665, 8 p.

As part of a series of investigations of the marine resources of Humboldt Bay, Calif., a larval fish survey was conducted from January to December 1969. Bottom and oblique tows were made at five sampling stations with 1-m plankton nets on alternate biweekly intervals. Thirty-seven species of larval and juvenile fishes representing 17 families were collected. In terms of larval abundance, the dominant fish was the bay goby, Lepidogobius lepidus, followed by Pacific herring (Clupea harengus pallasi), Pacific staghorn sculpin (Leptocottus armatus), longfin smelt (Spirinchus thaleichthys), and the arrow goby (Clevelandia ios). These five species constituted 95% of all larvae captured. The number of larvae captured increased with increasing distance from the mouth of the Bay. The lowest number of species captured was at a station which experienced the widest range of salinities and temperatures. Peaks of seasonal abundance occurred in January and February and in April and May. Relatively few fish were captured after June. Some notable appearances of offshore spawned fishes were found in Humboldt Bay. (Authors)

16038. Wittenberger, C. (Biol. Research Centre, Cluj, Roumania). 1972. THE GLYCOGEN TURNOVER RATE IN MACKEREL MUSCLES. Marine Biology, 16(4): 279-280.

Turnover rate of the glycogen glucose in the lateral trunk muscles and the liver was investigated in ^{14}C-glucose injected mackerels, Scomber scombrus. High values were recorded for the red-muscle glycogen; the values were about 40 times lower in the white muscle and the liver. Results are discussed in relation to the assumed metabolic function of the red muscle in fishes. (Auth.)

16039. MacCrimmon, Hugh R. (Dept. of Zool., College of Biol. Sci., Univ. of Guelph, Guelph, Ontario, Canada). 1972. WORLD DISTRIBUTION OF RAINBOW TROUT (Salmo gairdneri): FURTHER OBSERVATIONS. J. Fish. Res. Bd. Canada, 29(12): 1788-1791.

This note supplements a previous paper on the world distribution of the rainbow trout (Salmo gairdneri). While strong public acceptance of the species as a sport and food fish is expected to intensify the propagation and use of wild and domestic strains, no significant extension in naturalized range is anticipated because of environmental limitations. (Auth.)

16040. Marking, Leif L. (Bur. of Sport Fish. & Wildl., Fish Control Lab., La Crosse, Wisconsin). 1972. METHODS OF ESTIMATING THE HALF-LIFE OF BIOLOGICAL ACTIVITY OF TOXIC CHEMICALS IN WATER. U. S. Dept. of the Interior, Bur. of Sport Fish. & Wildl., Investigations in Fish Control, No. 46, 9 p.

In the absence of analytical methods, the half-life of biological activity of a chemical (the time required to decrease its toxic activity by one-half) can be estimated by bioassays. The methods presented require the determination of LC50 values (concentration producing 50% mortality) for organisms in aged solutions containing unknown residual concentrations, and concurrent tests of solutions containing known concentrations. The half-life of biological activity is determined by plotting (1) the percent concentrations remaining in aged solutions or (2) the deactivation indices against aging time on cyclic semilogarithmic graph paper. By the first method, a 5-day half-life for antimycin, a fish toxicant, was determined using resistant channel catfish (Ictalurus punctatus) and goldfish (Carassius auratus) and for sensitive green sunfish (Lepomis cyanellus) and rainbow trout (Salmo gairdneri) in soft water at pH 7.5. The second method, using only rainbow trout, also estimated a 5-day half-life for antimycin in soft water at pH 7.5. These methods could be used also to determine the half-life of antimycin at different pH's, temperatures, and light intensities, the factors thought to influence the toxicant's efficacy. The methods are not limited to fish and fish toxicants. (Auth.)

16041. Aoi, Hiroshi, Isao Abe, Takashi Saito, Hideaki Fukawa, and Hiroyasu Koyama. 1972. PREVENTIVE EFFECTS OF TOCOPHEROLS ON MUSCULAR DYSTROPHY OF YOUNG CARP. Bull. Jap. Soc. Sci. Fish., 38(8): 845-851; Fish Health News prepared at Eastern Fish Dis. Lab., Kearneysville, West Va., p. 9.

The preventive effects of four tocopherol homologues on muscular dystrophy in young carp were compared with the casein-gelatin diet containing oxidized mackerel body oil. From the appearance of muscular dystrophy, growth, feed conversion, and histopathological observations, it was concluded that α-tocopherol is far more effective than β, γ, δ-tocopherols, in order of decreasing potency. (Authors' summ.)

16042. Svobodova, Z. (Vyzkumny Ustav Rybarsky a Hydrobiologicky Vodnany, Prague, Czechoslovakia). 1971. SOME HAEMATOLOGICAL AND METABOLIC CHANGES IN FISH OCCURRING AFTER PESTICIDE INTOXICATION (Nektere hematologicke a metabolicke zmenyuryb po intoxikaci Pesticidy). Bulletin VUR Vodnany, 7(3): 29-36, English summ.; Selected Water Resources Abstracts, 5(23): p. 69.

The changes in some hematological and metabolic indices were examined in the carp after pesticide intoxication. The cases were peracute Metation E 50, Nitrosan 50, Trifenox TM 1:1, and Neren intoxication, and chronic intoxication with Metation E 50. The hematological indices under study were the following: erythrocyte number, content of hemoglobin, mean color concentration color index; the examination of the glycide metabolism included glycogen content in the hepatopancreas and glucose level in blood. The nature of the hematological changes in fish after pesticide intoxication (with the exception of Nitrosan 50) was almost the same in all cases. The main response of the fish to the pesticide preparations was a large increase in the mean erythrocyte volume, increase of hematocrit, and a significant reduction of mean color concentration. The response of the fish to the effect of Nitrosan 50 was the release of erythrocytes from the blood deposits.

Pesticide intoxication caused a decrease in the level of glycogen in the hepatopancreas and a significant increase in the level of glucose in the blood. These effects cannot be considered specific for the effect of pesticides, but pesticide intoxication should be considered a cause evoking these changes.

16043. LaBounty, James F., and James E. Deacon (Bur. of Reclam., Reg. 3, Phoenix, Arizona and Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1972. Cyprinodon milleri, A NEW SPECIES OF PUPFISH (FAMILY CYPRINODONTIDAE) FROM DEATH VALLEY, CALIFORNIA. Copeia, No. 4, 769-780.

Cyprinodon milleri is the fifth known species of its genus found in the Death Valley system, Nevada-California. Its entire population lives below mean sea level, in what may be one of the more extreme fish habitats yet discovered. Water temperatures range from near freezing in winter to more than 40 C in summer, and the fish is capable of survival in a salinity range from 0.0 to 78.5 g/l. The new species differs from its nearest apparent relatives by having a shorter and narrower caudal peduncle, a shorter predorsal length, fewer lachrymal pores, more scales, far larger jaw teeth that lack any prominent, central ridge, and pelvic fins reduced or absent. C. milleri appears to have undergone exceedingly rapid speciation because of its extreme habitat and isolation. (Authors)

16044. Rodgers, C. A., and Stalling, D. L. (U. S. Dept. of the Interior, Fish-Pesticide Lab., Columbia, Missouri). 1970. 2,4-D BUTOXYETHANOL ESTER UPTAKE, DISTRIBUTION AND ELIMINATION IN ORGANS OF RAINBOW TROUT, CHANNEL CATFISH AND BLUEGILLS. Abstracts of the Meeting of Weed Sci. Soc. of America, 97; Weed Abstracts, 21(3): p. 252, Abstr. 1549, 1972.

Groups of rainbow trout (Salmo gairdneri), channel catfish (Ictalurus punctatus) and bluegills (Lepomis macrochirus) were either fed a normal diet or were fasted for 48 h before and during exposure to 0.3 or 1 ppm of the butoxyethanol ester of 2,4-D (2,4-D BEE) for 168 h. A mixture of non-radioactive and ^{14}C-labelled herbicide was used. In general, maximum residues of the herbicide or its metabolites occurred 1 to 2 h after exposure in the organs of the fed fish and 1 to 8 h after exposure in the fasted fish. Residues varied from 2 to 200 ppm except in the gall bladders of fasted bluegills which contained 5268 ppm after exposure to 1 ppm of the herbicide for 24 h. Whole body residues after exposure in baths to 1 ppm of 2,4-D BEE reached peaks of 7.3 ppm after 1 h in fed channel catfish and 19.5 ppm after 2 h in the fasted fish. In fed bluegills the residues reached a peak of 54.6 ppm after 2 h while the fasted fish contained 54.6 ppm after 6 h. Both species then rapidly eliminated the 2,4-D BEE and after 24 h fed catfish and bluegills had whole body residues of 0.04 and 0.5 ppm respectively while the fasted fish had 1.2 and 7.5 ppm. This slower uptake and elimination of 2,4-D was typical of all the fasted fish tested. Fish extracts were further examined by thin-layer chromatography and autoradiograms. The autoradiograms indicated that the 2,4-D BEE had been completely hydrolysed to 2,4-D acid within 1 to 3 h.

16045. Kluytmans, J. H. F. M., and D. I. Zandee (Lab. of Chem. Animal Physiol., St. Univ., Utrecht, The Netherlands). 1973. LIPID METABOLISM IN THE NORTHERN PIKE (Esox lucius L.) - 1. THE FATTY COMPOSITION OF THE NORTHERN PIKE. Comp. Biochem. Physiol., 44(2B): 451-458.

The fatty acid composition of the total lipids from the northern pike was studied by standard gas-chromatographic methods, in combination with hydrogenation, i. r. spectroscopy and periodate-permanganate oxidation of semi-preparative collected peaks. Many different positional isomers appeared to be present in the unsaturated fatty acids. The presence of many of the quantitative important acids was in accordance with a biosynthesis starting from linoleic or α-linoleic acid. From the quantities of different isomers present the conclusion can be drawn that the first step in the conversion of these acids is an elongation to C20:2$^{\Delta 11, 14}$ and C20:3$^{\Delta 11, 14, 17}$ respectively, followed by further hydrogenation. The differences in the fatty acid composition of animals fed regularly or starved during 2 months were small. (Authors)

16046. Dragovich, Alexander, and Thomas Potthoff (NMFS, Southeast Fisheries Center, Miami Lab., 75 Virginia Beach Drive, Miami, Florida 33149). 1972. COMPARATIVE STUDY OF FOOD OF SKIPJACK AND YELLOWFIN TUNAS OFF THE COAST OF WEST AFRICA. NOAA Fishery Bulletin, 70(4): 1087-1110.

Stomach contents of 711 skipjack tuna (Katsuwonus pelamis)and 132 yellowfin tuna (Thunnus albacares) captured in 1968 by live bait and trolling off the coast of West Africa were examined. A marked taxonomic similarity was noted between the organisms in the diets of the two tunas. Frequency of occurrence, displacement volume, and numbers of each food item identified are presented for each species of tuna. Fishes, mollusks, and crustaceans were the principal foods with fishes generally dominant. The most prominent fish families were Acanthuridae, Carangidae, Dactylopteridae, Gempylidae, Gonostomatidae, Lutjanidae, Mullidae, Priacanthidae, Scombridae, Serranidae, and Trichiuridae; mollusks were chiefly cephalopods (squids), and crustaceans consisted mostly of macrozooplankton. Juvenile tunas were present in the diet of both species of tunas. Estimates of the size of forage organisms were primarily based on displacement volumes. In the majority of observations, food organisms displaced less than 1.0 ml and the displacement volumes of stomach contents varied for skipjack tuna from 0.1 to 20.0 ml and for yellowfin tuna from 0.1 to 60.0 ml. Spearman's rank correlation analysis was used to test for a relation between the food type (in volume and frequency of occurrence) and the lengths of skipjack and yellowfin tunas. Significant correlations were noted between the size of skipjack tuna and both the volume and the frequency of occurrence of forage fish. A comparison between the findings of our study and that of other food studies off the coast of West Africa showed greater taxonomic similarity in tuna forage when the studies were made in the same general area and that only several types of food were of primary importance in each given area. Seasonal changes in taxonomic composition of forage organisms were also discussed. The method used to evaluate food organisms consisted of ranking the organisms according to their dispersal indices, abundance indices, and biomass contribution. Stomatopods, the amphipod Phrosina semilunata, Teuthoidea, Carangidae, Serranidae, and megalopal stages were most important constituents of food throughout the investigation area. (Authors)

16047. Thorne, Richard E., Jerry E. Reeves, and Alan E. Millikan (College of Fisheries, Univ. of Wash., Seattle, Washington 98195). 1971. ESTIMATION OF THE PACIFIC HAKE (Merluccius productus) POPULATION IN PORT SUSAN, WASHINGTON, USING AN ECHO INTEGRATOR. WSG-TA-71-32, Contrib. No. 349, Coll. of Fish., Univ. of Wash., 10 p.; Sea Grant 70's published by Texas A&M Univ., College Station, Texas, 3(4): p. 6, 1972.

Integrators used for estimation of size of spawning stock were a simple voltage integrator (in 1969), and a voltage-squared integrator (in 1970). This change increased objectivity of the technique and enabled estimation of confidence intervals. The integrators were calibrated against net hauls on the assumption of 100% net efficiency. Major source of variability in estimates for both years was associated with net haul calibration. Alternate methods of calibration and improvements in technique are discussed.

16048. Bland, James K., and David Bardack (Dept. of Biol. Sci., Univ. of Ill. at Chicago Circle, Chicago, Illinois). 1973. A PLEISTOCENE PIKE Esox cf. lucius FROM THE SOUTHERN END OF LAKE MICHIGAN. Amer. Midl. Nat., 89(1): 138-144.

A fossil fish, referable to Esox lucius, is described from a site at the southern end of Lake Michigan. The age of the fossil, Late Pleistocene (Lake Chippewa stage), and locality demonstrate the occurrence of northern pike during postglacial times within the present range of this species. Also found with the pike were scales of the centrarchid Lepomis. Together these fossils constitute an addition to the sparse data on the past fish fauna of the Lake Michigan region. (Authors)

16049. McErlean, Andrew J., Catherine Kerby, and Marvin L. Wass (Dept. of Environ. Res., Nat. Res. Inst., Univ. of Md., Hallowing Pt. Sta., Prince Frederick, Maryland). 1972. BIOTA OF THE CHESAPEAKE BAY. Chesapeake Science, Vol. 13, Supplement, 197 p.

16050. Bangham, R. V. 1972. A RESURVEY OF THE FISH PARASITES OF WESTERN LAKE ERIE. Bull. Ohio Biol. Surv., 4(2): 1-23.

Parasites from fish collected from the west end of Lake Erie were identified and compared with the results of a similar study made during 1927-29 (published in 1939). In the present study 1,687 fish belonging to 66 species were examined in 1957 of which 1,589 or 94.2% were parasitized. The 1939 report cited 58.3% parasitized, but the investigator had probably become more proficient in the interim. No lake herring or whitefish were taken and fewer specimens of blue pike, sauger, and burbot were available in 1957, but bullheads, carp, white bass, rock bass, crappies, sunfish, bluegill, and sheepshead were more readily available. One hundred and ten species of parasites were encountered, including the following of economic importance: Ichthyophthirius multifiliis, Clinostomum marginatum, Diplostomulum flexicaudum, Posthodiplostomum minimum, Proteocephalus ambloplitis, Eustrongylides sp., and Philometra cylindracea. Tables of all parasites found, as well as a comparison of the 1939 and 1957 surveys, are given -- Glenn L. Hoffman

16051. Romanenko, V. I. (Inst. of Biol. of Inland Waters, USSR Acad. of Science, Borok, USSR). 1971. PRODUCTION OF ORGANIC MATTER BY PHYTOPLANKTON IN THE RYBINSK RESERVOIR. Hydrobiological Journal, 7(4): 1-6.

In the typically mesotrophic Rybinsk Reservoir, the total photosynthetic production of organic matter by phytoplankton averaged 76 grams of carbon per square meter, during the growing season (May-October) over a ten-year period with a range of variation from 27 to 144 grams of carbon per square meter. This represents a 0.12% utilization of solar energy. The fish caught in the reservoir account for approximately 1 kcal/m^2 yr, a quantity corresponding to 0.2% of the primary production and 0.0002% of the solar radiation incident on the water. The breakdown of autochthonous and allochthonous organic matter in the water and sediments of the reservoir exceeds the primary production by the phytoplankton by a factor of two.

16052. Tiemeier, O. W., C. W. Deyoe (Div. of Biol., Kansas State Univ., Manhattan, Kansas). 1972. FLOATING OR SINKING FEED...WHAT'S BEST FOR YOU? Fish Farming Industries, June 1972, pp. 18-20.

Experiments indicate production of channel catfish fingerlings was similar when fish were fed similar feeds as either sinking or floating pellets. Floating feeds may be most valuable as a management tool to determine: 1. When fish will take feed and how much early and late in the feeding season. 2. effects of low dissolved oxygen content in the water on feeding. 3. effects of low or high water temperature on feeding. 4. general vigor or health of fish during the feeding season. 5. how much feed fish are taking during the feeding season. 6. amounts of feed to give fish in special circumstances such as cage feeding, raceway feeding and in ponds having much rooted vegetation. 7. that fish are present and that they are taking feed. (From authors' conclusions)

16053. Iwatsubo, R. T., L. J. Britton, and R. C. Averett (Geological Survey, Menlo Park, California). 1972. SELECTED PHYSICAL AND CHEMICAL CHARACTERISTICS OF 20 CALIFORNIA LAKES. Geological Survey Open-file Report, May 16, 1972, 59 p.; Selected Water Resources Abstracts, 6(1): p. 9.

In the summers of 1969 and 1970 the U. S. Geological Survey made limnological surveys on 20 California lakes and reservoirs. The lakes ranged from the unenriched waters of the Sierra Nevada to the enriched lake waters in the Central Valley and northeast prairie region of the State. Temperature and dissolved-oxygen measurements showed that most of the lakes were thermally stratified and had well-defined metalimnions. Dissolved-oxygen profiles varied widely among the lakes. Three of the lakes had metalimnetic oxygen depletion, but most had the oxygen minimum near the bottom, at the sediment water interface. Alkalinity, pH, and specific conductance varied as a function of photosynthetic or respiratory activity of the biota. Light penetration estimated with a Secchi disk ranged from the middle depths of the clear Sierra Nevada lakes to near the surface in the enriched waters. Water samples collected at the 1-meter depth for the determination of the major dissolved chemical constituents showed wide chemical variations among the lakes.

16054. Markiewicz, Franciszek. 1972. INFLAMMATION OF THE SWIMBLADDER IN THE CARP (Cyprinus carpio L.). Acta Hydrobiologica, 14(4): 375-397. In Eng.

In the course of inflammation of the swimbladder of carp two kinds of changes were observed - general organic changes and local ones within the swimbladder itself, changes in the carp fry being slightly different from those taking place in older age groups. While in the latter productive processes - hypertrophy of the swimbladder walls and the appearance of great masses of fibrion - were predominant, in younger carp circulatory disturbances in the form of peri-swimbladder hyperaemia, infiltrations, exudates and gas cysts were found above all. Morphological changes in artificially infected fish were similar to those occurring in natural conditions. The course of the disease and the observations and tests carried out indicate that inflammation of the swimbladder is an infectious disease. Descriptions of changes are illustrated with macro- and microscopic photographs. (Auth.)

16055. Hewitt, G. C., and R. W. Little (Zool. Dept., Victoria Univ., Wellington, New Zealand). 1972. WHIRLING DISEASE IN NEW ZEALAND TROUT CAUSED BY Myxosoma cerebralis (Hofer, 1903) (PROTOZOA: MYXOSPORIDA). New Zealand Journal of Marine and Freshwater Research, 6(1,2): 1-10.

Examination of diseased rainbow trout (Salmo gairdneri) from a trout hatchery in New Zealand revealed spores of Myxosoma cerebralis. Fish also exhibited the typical signs of infection: "whirling" movements when disturbed, skeletal deformities and tail darkening. Records suggest that the disease may have been present for some years. A brief summary of the parasite's life cycle is given, and recommendations are made for legislation to reduce the possibility of its spread to other hatcheries and to reduce the risk of importing other disease organisms into New Zealand. (Authors)

16056. Buetikofer, L. B., and D. D. Meredith (Water Resources Center, Ill. Univ., Urbana, Illinois). 1972. ANNOTATED BIBLIOGRAPHY ON GREAT LAKES HYDROLOGY. Available from NTIS as PB-212 251, $4.50 paper copy, $0.95 in microfiche; Ill. Water Resources Center Research Report No. 56, 62 p.; Selected Water Resources Abstracts, 5(24): p. 15.

This bibliography contains 233 literature references on Great Lakes hydrology. The references are listed alphabetically by author for the following topics: precipitation; evaporation; runoff; lake levels and flows; hydrologic budget; currents, winds, and water temperature; and general.

16057. Kimura, Seiro (Fish. Lab., Fac. of Agric., Kyushu Univ., Fukuoka shi, Japan). 1972. ON THE SPAWNING BEHAVIOR OF THE FLUVIAL DWARF FORM OF MASU SALMON, Oncorhynchus masou. Jap. J. Ichthyol., 19(2): 111-119. In Japanese with English abstract, tables and figures.

Observations on the spawning behavior of the fluvial dwarf form of masu salmon, Oncorhynchus masou (Brevoort), were made in the Ishido-dani, a tributary of Hitotsuse River in Miyazaki Pref., in the autumn of 1957 and 1969. During the spawning season from the last part of October to the first part of November, the water temperature was 13.5 - 15.5°C and the spawning act of a female and several males was observed usually in the pool-end. In the male group the hierarchy of peck-right type is recognized according to their body sizes and the largest one mates with the female. The paired male immediately drives subordinate males away if they attempt to approach the female. The female defends her site from invaders such as males which are smaller than herself or another female which tries to dig the site of the paired female. The feeling and/or crouch of the female is thought to be the signal posture that causes courting of males, and when the paired male is in the similar posture, homosexual courtship of another smaller male is occasionally observed. As the female repeats digging movement at the rate of twice a minute, a shallow depression is made in which the oviposition occurs. At the oviposition, 30-100 eggs are shed into the crevices of gravel remained in the center of the depression. In the postspawning stage only the female remains on her redd and she covers the eggs with sand and smaller gravel of the upstream part

from the depression. Several hours after the first oviposition, the males appear again near the female which is making another depression at about 20 cm upstream place from the previous one, and they repeat the same acts as they did in the first prespawning stage. The next oviposition is usually observed 25-30 hours after the first one. Three or 4 days are necessary for 2 or 3 times of oviposition. (Auth.)

16058. Goodnight, Clarence J. (Dept. of Biol., W. Mich. Univ., Kalamazoo, Michigan). 1973. THE USE OF AQUATIC MACROINVERTEBRATES AS INDICATORS OF STREAM POLLUTION. Trans. Amer. Micr. Soc., 92(1): 1-13.

The presence of aquatic organisms often provides the best indication of the condition of a stream. Most groups of aquatic organisms have been suggested as valuable indicator species. All groups have some merit, but none are adequate alone. The tendency now is to consider the entire community as a unit of study in determining the health of a stream. Several useful techniques of reporting these community analyses are discussed. (Auth.)

16059. Niimi, A. J. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1972. TOTAL NITROGEN, NONPROTEIN NITROGEN, AND PROTEIN CONTENT IN LARGEMOUTH BASS (Micropterus salmoides) WITH REFERENCE TO QUANTITATIVE PROTEIN ESTIMATES. Canad. J. Zool., 50(12): 1607-1610.

Nonprotein nitrogen (NPN) content in largemouth bass accounted for 9% of the total nitrogen content. This level was influenced by feeding level and probably body weight. A consideration for NPN is essential for quantitative protein estimates. (Auth.)

16060. McCarthy, D. H., J. P. Stevenson, and M. S. Roberts (Fish Dis. Res. Unit, Ministry of Agric., Fish. and Food, Weymouth, England). 1973. SOME BLOOD PARAMETERS OF THE RAINBOW TROUT (Salmo gairdneri Richardson) I. THE KAMLOOPS VARIETY. Journal of Fish Biology, 5(1): 1-8.

Fifty rainbow trout of the Kamloops strain were examined for 12 haematological parameters: erythrocyte sedimentation rate, haemoglobin, packed cell volume, erythrocyte count, erythrocyte diameters, mean cell volume, mean cell haemoglobin concentration, leukocyte count, differential leukocyte count, plasma total protein and plasma glucose concentration. The fish had been held under known environmental and dietetic conditions, and at the time of sampling were 14 months old. The majority of results for erythrocyte sedimentation rate, haemoglobin, packed cell volume, erythrocyte count, erythrocyte diameters, total protein and differential leukocyte count fell within narrow ranges. The total leukocyte counts and glucose levels were more widely spread. The results are discussed and compared with those already published for Idaho and Shasta strains. It is impossible to say whether the differences that were observed between Kamloops and these other varieties were due to strain alone, since other variables were present. Some problems associated with establishing normal ranges for these parameters in fish are discussed. (Authors)

16061. Burton, Robin. 1972. ENGINEERING BETTER FISH. Sea Frontiers, 18(3): 175-180.

This popularized article describes work being conducted at the Fishery Research Laboratory of the British Ministry of Agriculture and Fisheries at Lowestoft by Dr. Colin Purdom. This research is aimed at producing inbred stocks of fish in which desirable qualities are preserved and undesirable ones are eliminated by selection. Special techniques employed in the research to reduce the time required to produce a good inbred line are described: gynogenesis, cold baths to produce polyploidy. Work has been done with plaice and is now being conducted with trout.

16062. Lambou, Victor W. (U. S. Environ. Protection Agency, Washington, D. C.) 1972. REPORT ON THE PROBLEM OF MERCURY EMISSIONS INTO THE ENVIRONMENT OF THE UNITED STATES TO THE WORKING PARTY ON MERCURY, SECTOR GROUP ON UNINTENDED OCCURRENCE OF CHEMICALS IN THE ENVIRONMENT, OECD. U. S. Environmental Protection Agency, 81 p.

16063. Scott, D. P., and F. A. J. Armstrong (Dept. of the Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg R3T 2N6, Manitoba, Canada). 1972. MERCURY CONCENTRATION IN RELATION TO SIZE IN SEVERAL SPECIES OF FRESHWATER FISHES FROM MANITOBA AND NORTHWESTERN ONTARIO. J. Fish. Res. Bd. Canada, 29(12): 1685-1690.

Statistical analysis of 53 samples of 11 species of fishes from a number of areas of Manitoba and northwestern Ontario indicated that in general there was a positive correlation between mercury concentration and length. There also appeared to be a more variable positive relation between mercury concentration and fish condition (fatness). It was possible to predict, for 31 of the 53 samples, the range of lengths within which there was a 95% probability of all fish containing less than 0.5 ppm mercury. However, within species the relation between mercury concentration and length was not consistent. The results show that, for certain of the populations closed to commercial fishing because of mercury contamination, selection (by fishing technique or otherwise) of certain sizes should provide fish of acceptably low mercury concentration. (Authors)

16064. Larsson, Åke, and Kerstin Lewander (Dept. of Zoophysiol., Univ. of Goteborg, Goteborg, Sweden). 1973. METABOLIC EFFECTS OF STARVATION IN THE EEL, Anguilla anguilla L. Comp. Biochem. Physiol., 44(2A): 367-374.

The effects of starvation on different metabolites in blood, liver and muscle were studied in eels (Anguilla anguilla L.) after 8, 95 and 145 days. During the first 95 days the eels apparently tended to utilize liver triglycerides as energy source. An increased liver glutamate oxaloacetate transaminase activity and maintenance of glycogen levels suggested a stimulated gluconeogenesis. Between 95 and 145 days the eels utilized great amounts of both liver and muscle triglycerides. There was also a marked decrease in liver glycogen during this latter phase of starvation. The starvation also resulted in a significant decrease in blood glucose both after 95 and after 145 days. (Authors)

16065. Gajan, Raymond J., and Damon Larry (Food and Drug Admn., Washington, D. C.). 1972. DETERMINATION OF LEAD IN FISH BY ATOMIC ABSORPTION SPECTROPHOTOMETRY AND BY POLAROGRAPHY. I. DEVELOPMENT OF THE METHODS. Journal of the Assn. of Official Analytical Chemists, 55(4): 727-732; Comm. Fish. Abstr., 26(2): p. 17.

The present Association of Official Analytical Chemists (AOAC) methods for the determination of lead require ashing the sample, extraction with dithizone or as the sulfide, followed by colormetric analysis of the dithizonate in Nessler tubes or in a spectrophotometer. A reliable method for the determination of trace amounts of lead in fish was needed. Colorimetric analysis was not sufficiently specific for trace amounts. Based on work of the U. S. Department of Commerce, National Bureau of Standards, (Technical News Bulletin, NBS-STR 4261, (June 1971) the polarographic technique was selected as suitable for trace analysis. Atomic absorption spectrophotometry (AAS) was selected as a check method in the development of the polarographic technique. Samples of fish weighing about 20 g. each were dry ashed at 500°C. The resulting ash weighed about 1.3% of the sample. The ash was dissolved in 1N HCl and analyzed for lead by AAS and by polarography. Good agreement between the two techniques was observed at levels of 1.0 to 10.0 ppm; however, below 1.0 ppm AAS measurements were biased. The bias was overcome by increasing the sample size fourfold. For polarography the average recovery from various species of fish was 100.7 plus or minus 9.0% and for AAS 95.7 plus or minus 9.2%. The authors suggest that the polarography method may be used as the determinative step for lead levels of about 0.1 ppm; AAS may be used at the 1.0 ppm level.

16066. Fraser, J. C. (Environ. Protection Authority, Victoria, Australia). 1972. WATER LEVELS, FLUCTUATION, AND MINIMUM POOLS IN RESERVOIRS FOR FISH AND OTHER AQUATIC RESOURCES - AN ANNOTATED BIBLIOGRAPHY. FAO Fisheries Technical Paper No. 113, 42 p. (Distribution restricted).

16067. Douglas, Neil H. (Dept. of Biol., Northeast Louisiana Univ., Monroe, Louisiana). 1972. Noturus taylori, A NEW SPECIES OF MADTOM (PISCES, ICTALURIDAE) FROM THE CADDO RIVER, SOUTHWEST ARKANSAS. Copeia, No. 4, pp. 785-789.

Noturus (Rabida) taylori, a new madtom, is described from 300 specimens collected from the Caddo River (Ouachita River drainage) in Arkansas. It is known only from the upper waters of the Caddo River. It is most closely related to Noturus elegans and Noturus miurus, but differs from the former by size of eye and dorsal fin pigmentation and from the latter by size of spines and adipose fin pigmentation. It is compared with all other members of the subgenus Rabida. It represents the second species of fish apparently endemic to the upper waters of this small river. (Auth.)

16068. Kluytmans, J. H. F. M., and D. I. Zandee (Lab. of Chem. Animal Physiol., St. Univ., Utrecht, The Netherlands). 1973. LIPID METABOLISM IN THE NORTHERN PIKE (Esox lucius L.) - II. THE COMPOSITION OF THE TOTAL LIPIDS AND OF THE FATTY ACIDS ISOLATED FROM LIPID CLASSES AND SOME TISSUES OF THE NORTHERN PIKE. Comp. Biochem. and Physiol., 44(2B): 459-466.

The percentage composition of lipid classes of total lipids from the northern pike (Esox lucius L.) is given. The total lipids consisted mainly of polar lipids (51%), cholesterol (13%) and triglycerides (27%). The fatty acid composition of these lipid classes was studied. A high concentration of C 22:6 was found in polar lipids, diglycerides and cholesterol esters, while C 20:5 and C 22:5 were the major polyunsaturated fatty acids in triglycerides. The fatty acid spectra of polar lipids and diglycerides showed a strong mutual resemblance. The fatty acid composition of total lipids from liver, muscle, intestine, gills, ovaries and testis was studied. The fatty acid composition of the testis lipids differed considerably from those of lipids isolated from other organs in containing a very high concentration of long chain polyunsaturated fatty acids. The differences in the fatty acid composition of the other tissues were much less pronounced. (Authors)

16069. Rao, K. S. P. Bhushana, and Ch. Gerday (Lab. of Gen. Biol., Fac. of Sci., Univ. of Liege, Liege, Belgium). 1973. LOW MOLECULAR WEIGHT PROTEINS OF PIKE (Esox lucius) WHITE MUSCLES - I. EXTRACTION AND PURIFICATION - POLYMORPHISM. Comp. Biochem. Physiol., 44(3B): 931-938.

The white muscles of pike (Esox lucius) contain two low molecular weight proteins which have been isolated by acetone fractionation, filtration on Sephadex G-75 and chromatography on DEAE-cellulose at pH 5.7. The purity of the two proteins was checked by starch gel electrophoresis. Regional gene duplication and tetraploidization seem to explain very well the variable number of these proteins in different fish species. (Authors)

16070. Fukui, S., K. Tanaka, S. Kanno, and T. Ukita (Kanagawa Prefectural Environ. Control Center, Yokohama, Japan). 1972. IMPROVEMENTS IN THE DETERMINATION METHOD OF METHYL MERCURY IN FISH TISSUES AND THE RATIO OF METHYL MERCURY TO TOTAL MERCURY IN FISH TISSUES. Presented at 6th Inter. Water Pollution Res. Conf., Jerusalem, Israel, June 18-23, 1972. Paper No. 27, Section C, Session 13, June 22, 1972, 9 p.; Selected Water Resources Abstracts, 5(24): p. 51.

The experimental conditions necessary to obtain the correct results on the determination of the ratio of methylmercury to total mercury in fish tissues were found. Using papaine digestion, an automatic extraction procedure and the internal standard method, reproducibility can always be obtained in each step of the determination procedure. The step by step laboratory procedure for the new method has been presented, followed by a comparison between the FDA method and the modified method. In the FDA method, the recovery of mercury seems to be changed with each sample. The cause might be the emulsion formed in directly treating fish tissues with benzene. The modified method overcomes these difficulties. The recovery of mercury added to the fish tissue is almost always 90 plus or minus 2%. The ratio of methylmercury to total mercury in one sample of the spearfish was 80.3% and in albacore, 66.6%.

16071. Hewitt, G. C., and P. M. Hine (Zool. Dept., Victoria Univ. of Wellington, New Zealand). 1972. CHECKLIST OF PARASITES OF NEW ZEALAND FISHES AND OF THEIR HOSTS. N. Z. Journal of Marine and Freshwater Research, 6(1, 2): 69-114.

Three hundred and fifty-six species of parasites (70 Protozoa, 1 Aspidogastra, 82 Digenea, 37 Monogenea, 2 Cestodaria, 36 Cestoda, 59 Nematoda, 4 Acanthocephala, 6 Hirudinea, 53 Copepoda, 1 Branchiura, 2 Isopoda) are listed from 140 species of fish from New Zealand and the Subantarctic Islands. The hosts are divided into Agnatha (1 species), Elasmobranchii (21 species), Holocephali (1 species) and Teleostei (117 species) and listed within these groups in alphabetical order of genus and then species: parasites are listed with the species on which they occur and the site of parasitism is specified if known. Indexes are provided to the parasites and to the families of the host genera. (Authors)

16072. Gorodnichiy, A. Ye. (Azov Fisheries Inst., Rostov-on-Don, USSR). 1971. METHODS OF IMPROVING THE NATURAL SPAWNING GROUNDS OF THE SEMI-MIGRATORY FISH OF THE DON RIVER. Hydrobiological Journal, 7(4): 40-44.

Gradual rise in the water level from March to May creates favorable conditions for spawning and for development of the eggs of fish, as well as of the food for the newly hatched fish. A water supply condition of this kind is observed in spawning grounds during the first year of establishment of reservoirs. This condition should be reproduced by improving the natural spawning grounds of semimigratory fish in the Don.

16073. Wallace, Dale C. (Dept. of Biol., Eastern Mich. Univ., Ypsilanti, Michigan). 1973. THE DISTRIBUTION AND DISPERSAL OF THE SILVERJAW MINNOW, Ericymba buccata Cope. Amer. Midl. Nat., 89(1): 145-155.

The present distribution of the silverjaw minnow determined by examination of museum specimens, museum records and the literature is explained by dispersal from a center in eastern Kentucky and West Virginia and, perhaps, southeastern Missouri. It survived glacial advances in these areas and moved down the Mississippi Valley probably during an early glacial advance. Dispersal through the eastern Gulf drainages was accomplished during sea level lowering via lowland connections. From the northern refuges it migrated down the Monongahela - Youghiogheny and Cheat rivers in post-Illinoian or post-Wisconsin times. From here it entered the Potomac via stream capture of the Youghiogheny or capture from the Cheat to the Potomac. It entered Ohio and Indiana in post-Wisconsin times, and subsequently entered Illinois from the E across the watersheds of the Wabash and Kaskaskia rivers and through early connections from the Tippecanoe to the Kankakee and Iroquois rivers. Entrance into the Lake Erie drainages probably took place through the Maumee Outlet, but it also may have occurred more recently across drainage divides in Indiana and Ohio. Present populations exhibit a rather wide N-S discontinuity in the eastern United States. Apparently, this species was not able to survive in the Green, lower Cumberland and Tennessee Rivers. Silting, especially in the lower reaches of these drainages, may account for this. (Auth.)

16074. Leeling, N. C. (Inst. of Water Res., Mich. State Univ., East Lansing, Michigan). 1972. POLYCHLORINATED BIPHENYLS IN COHO SALMON FROM WATERS OF LAKE MICHIGAN. Available from NTIS as PB-212 588, $3.00 paper copy, $0.95 microfiche. Mich. Inst. of Water Res., Lansing, Completion Report 6 p., OWRR A-044-MICH (1); Selected Water Resources Abstracts, 6(1): p. 33.

Various physical and chemical methods used in attempts to separate the DDT complex, especially DDE, from polychlorinated biphenyls (PCB's) proved unsuccessful on a quantitative basis. These methods included high-speed liquid column chromatography, sulfuric and permanganate oxidation and derivatization with tetraphenylcyclopentadienone.

16075. Hunn, Joseph B. (Bur. Sport Fish. & Wildl., Fish Control Lab., LaCrosse, Wisconsin). 1972. CONCENTRATIONS OF SOME INORGANIC CONSTITUENTS IN GALLBLADDER BILE FROM SOME FRESHWATER FISHES. Copeia, No. 4, pp. 860-861.

16076. Eppley, Richard W. (Inst. of Marine Resources, Univ. of Calif., San Diego, P. O. Box 109, La Jolla, California 92037). 1972. TEMPERATURE AND PHYTOPLANKTON GROWTH IN THE SEA. NOAA Fishery Bulletin, 70(4): 1063-1085.

The variation in growth rate with temperature of unicellular algae suggests that an equation can be written to describe the maximum expected growth rate for temperatures less than 40°C. Measured rates of phytoplankton growth in the sea and in lakes are reviewed and compared with maximum expected rates. The assimilation number (i.e., rate of photosynthetic carbon assimilation per weight of chlorophyll a) for phytoplankton photosynthesis is related to the growth rate and the carbon/chlorophyll a ratio in the phytoplankton. Since maximum expected growth rate can be estimated from temperature, the maximum expected assimilation number can also be estimated if the carbon/chlorophyll a ratio in the phytoplankton crop is known. Many investigations of phytoplankton photosynthesis in the ocean have included measures of the assimilation number, while fewer data are available on growth rate. Assimilation numbers for Antarctic seas are low as would be expected from the low ambient temperatures. Tropical seas and temperate waters in summer often show low assimilation numbers as a result of low ambient nutrient concentrations. However, coastal estuaries with rapid nutrient regeneration processes show seasonal variations in the assimilation number with temperature which agree well with expectation. The variation in maximum expected growth rate with temperature seems a logical starting point for modeling phytoplankton growth and photosynthesis in the sea. (Auth.)

16077. Mackiewicz, John S. (Biol. Sci., State Univ. of N. Y. at Albany, Albany, New York). 1972. TWO NEW SPECIES OF CARYOPHILLID TAPEWORMS FROM CATOSTOMID FISHES IN TENNESSEE. J. Parasit., 58(6): 1075-1081.

Biacetabulum hoffmani sp. n. is described from Hypentelium etowanum and Moxostoma erythrurum: Isoglaridacris jonesi sp. n. is from the latter host and M. duquesnei. B. hoffmani differs from the other 2 nonacetabulate species in the genus by having conspicuous bothria and a disc on the scolex, a short neck, and twice the number of testes. I. jonesi differs from others in the genus primarily by lacking post-ovarian vitellaria and having weakly developed loculi on the scolex. A discussion of pertinent morphological features, comparisons with related species, and note of intensity and incidence data follow each description. (Auth.)

16078. Cameron, James N., and David J. Randall (Inst. of Arctic Biol., Univ. of Alaska, College, Alaska). 1972. THE EFFECT OF INCREASED AMBIENT CO_2 ON ARTERIAL CO_2 TENSION, CO_2 CONTENT AND pH IN RAINBOW TROUT. J. Exp. Biol., 57(3): 673-680.

The effect of exposure of rainbow trout to high and low levels of environmental (water) CO_2 tension on blood CO_2 and pH was studied. An increase in environmental CO_2 caused a rise in the arterial CO_2 tension (Pa_{CO_2}), but the blood-to-water gradient (P_I-Pa) remained about the same. Changes in arterial pH were small - about one-third of what would be predicted from the change in Pa_{CO_2} if plasma bicarbonate remained constant. There was a corresponding increase in the total CO_2 content of the blood which involved an upward shift of the CO_2 dissociation curve, and readjustment of the buffering to maintain pH. The results are consistent with the hypothesis that blood CO_2 and pH levels are regulated via a chloride-bicarbonate exchange mechanism, rather than by ventilation and diffusive washout of gaseous CO_2. (Authors' summ.)

16079. Hubbs, Clark, and Roland Waver (The Univ. of Texas at Austin, Texas). 1973. SEASONAL CHANGES IN THE FISH FAUNA OF TORNILLO CREEK, BREWSTER COUNTY, TEXAS. The Southwestern Naturalist, 17(4): 375-379.

The fish fauna of Tornillo Creek is primarily composed of temporary inhabitants during breeding and rearing seasons. Introduced Fundulus kansae may compete with and may have reduced population densities of native Campostoma ornatum. (Authors)

16080. Lucký, Z. (Dept. Parasitol. and Invasive Dis., Div. Fish and Bee Dis., Univ. - Sch. Vet. Med., Brno, Czechoslovakia). 1970. PATHOLOGICAL CHANGES AND DIAGNOSTICS OF MYXOSOMOSIS OF THE RAINBOW TROUT (Salmo gairdneri irideus). Acta Vet. Brno, 39 (Suppl. 1), pp. 19-29; Aquatic Sci. & Fish. Abs. Aq7165F; Fish Health News prepared at Eastern Fish Dis. Lab., Bur. Sport Fish. & Wildl., Kearneysville, W. Va. 25430, p. 13.

Pathological changes were studied of myxosomosis of trout fry 2 months and 6 months old. The trout came from the fish farm in the Moravian Carst (drainage area of the river Punkva). In 2-month-old trout clinical symptoms of myxosomosis were observed and proved by histological examination as well. Amoebids with several nuclei were diagnosed in the cartilages of the skull. Towards the end of Oct. further specimens of trout from the breeding pond were examined. Some trout were found to have a deformed spine. By parasitological examination spores of Myxosoma cerebralis were diagnosed. By histological examination numerous foci of myxosporidia were found in the cartilage of the head bones. Vegetative stages were registered as well as sporoblasts and mature spores. Some foci were enclosed into an osseous pallium, others were surrounded by a granular tissue of mesenchymal cells. The discussion deals with the determination of the age of pathological-anatomical processes and of the parasites. The examinations performed showed that even after 5 months the reproduction of the parasite was probably not finished; however, an expressive tissue proliferation occurs and also encapsulation of the parasites. -- Aquatic Sci. & Fish. Abs.

16081. Leach, Lowell E., and Curtis C. Harland, Jr. 1970. INDUCED AERATION OF SMALL MOUNTAIN LAKES. Environ. Protection Agency, Water Pollution Control Research Series 16080, 54 p.; Univ. of Wis. Water Resources Center Eutrophication Program, No. 32, No. 4375, p. 9.

A technique of managing trout-fishery lakes, through introduction of compressed air, was studied at Lake Roberts in southern New Mexico during the summer of 1969. Research findings and further research required for optimum development of induced aeration systems as management tools for trout-fishery lakes are discussed.

16082. Lupacheva, L. I., and R. A. Baltadzhi. 1971. A STUDY OF THE HIGHER AQUATIC VEGETATION OF THE COOLANT-RESERVOIR OF THE MIRONOVSKAYA GRES (THERMAL POWER STATION) IN RELATION TO STOCKING WITH HERBIVOROUS FISH. Rybnoe Khozyaistvo, Ukraine, No. 12, pp. 75-77; Weed Abstracts, 21(2): p. 139, Abstr. 848, 1972.

The reservoir has been regularly stocked with herbivorous fish (grass and silver carp and bighead) since 1964 and in July 1969 the vegetation was surveyed for changes since the previous survey in July 1962. All plants from 1-m^2 quadrats were weighed (fresh wt.), counted and measured. In 1962, 7% of the 420-ha reservoir was overgrown with weeds weighing about 1400 t; in 1969, the figures were 7.5% and 1210 t respectively. In 1962, Phragmites communis occupied 18 ha and weighed 666 t, Typha latifolia 7 ha and 525 t and Ceratophyllum demersum 1.3 ha and 117 t respectively. In 1969, P. communis occupied 18 ha and weighed 712 t, C. demersum 4.3 ha and 78 t, T. angustifolia 3.4 ha and 162 t and T. latifolia 1.8 ha and 174 t respectively; 92.3% of the total vegetation was emergent, 6.5% submersed and 1.2% floating. In spring and early summer, there was an abundance of green filamentous algae, Potomogeton filiformis, and P. pusillus which provide excellent food for grass carp; P. communis, C. demersum and T. latifolia are also readily eaten. An examination of weed stands showed that T. angustifolia was replacing T. latifolia everywhere and that whereas 185 plants of C. demersum weighing 9 kg had been counted per m^2 in 1962 the number had decreased to 29/m^2 weighing 1.8 kg in 1969. The reservoir was currently producing about 25 t fish/ha and this could be at least double if grass carp consumed all of the remaining 1210 t of higher vegetation growing in July 1969 (50 t of vegetation per 1 t of fish).

16083. Kami, Harry T. (Div. of Fish & Wildl., Dept. of Agric., Territory of Guam, Agana, Guam). 1971. CHECK-LIST OF GUAM FISHES, SUPPLEMENT I. Reprint from Micronesica, 7(1, 2): 215-228.

16084. Biesinger, Kenneth E., and Glenn M. Christensen (U. S. Environ. Protection Agency, Nat'l. Water Qual. Lab., 6201 Congdon Blvd., Duluth, Minnesota). 1972. EFFECTS OF VARIOUS METALS ON SURVIVAL, GROWTH, REPRODUCTION, AND METABOLISM OF Daphnia magna. J. Fish. Res. Bd. Canada, 29(12): 1691-1700.

The toxicities of various metals to Daphnia magna were evaluated on the basis of a 48-hr 50% lethal concentration (LC50) a 3-week LC50, and a 16% decrease in the number of young born (reproductive impairment). The 3-week 16% reproductive impairment concentrations (in micrograms per liter) for the metal ions tested were: Na(I), 680,000; Ca(II), 116,000; Mg(II), 82,000; K(I), 53,000; Sr(II), 42,000; Ba(II), 5800; Fe(III), 4380; Mn(II), 4100; As(V), 520; Sn(II), 350; Cr(III), 330; Al(III), 320; Zn(II), 70; Au(III), 60; Ni(II), 30; Pb(II), 30; Cu(II), 22; Pt(IV), 14.; Co(II), 10; Hg(II), 3.4; and Cd(II), 0.17. At metal concentrations permitting survival but impairing reproduction, daphnids weighed less than control animals. Amounts of total protein and glutamic oxalacetic transaminase activity varied with the different metals. The negative logarithm of the solubility product constant (pKsp) of the metal sulfides, electronegativity, and the logarithm of the equilibrium constant (log Keg) of the metal-ATP complex were positively correlated with toxicity to D. magna. Other physicochemical properties were considered, but no additional correlations were found. (Authors)

16085. Carey, Francis G., and Kenneth D. Lawson (Dept. of Biol., Woods Hole Oceanogr. Inst., Woods Hole, Massachusetts). 1973. TEMPERATURE REGULATION IN FREE-SWIMMING BLUEFIN TUNA. Comp. Biochem. and Physiol., 44(2A): 367-374.

Acoustic telemetry was used to monitor ambient water temperature and tissue temperature in free-swimming bluefin tuna (Thunnus thynnus Linnaeus, 1758) over periods ranging from a few hours to several days. Bluefin, which experienced marked changes in water temperature, showed excellent regulation of the temperature of the stomach and epaxial muscles. Other species, bigeye tuna (Thunnus obesus Lowe, 1893) and dusky shark (Carchorhinus obscurus LeSueur, 1818) did not appear to control their body temperatures. The bluefin does not have a fixed temperature set-point: fish taken from the same school may vary 5°C or so in their maximum muscle temperature, and on occasions the body temperatures of fish we followed were observed to change independently of water temperature. (Authors)

16086. Oviatt, C. A., A. L. Gall, and S. W. Nixon (Grad. School of Oceanogr., Univ. of R. I., Kingston, Rhode Island). 1972. ENVIRONMENTAL EFFECTS OF ATLANTIC MENHADEN ON SURROUNDING WATERS. Chesapeake Science, 13(4): 321-323.

Schools of Atlantic menhaden, Brevoortia tyrannus, have measurable effects upon the estuarine waters of Narragansett Bay, Rhode Island by their feeding, respiration and excretion. The concentrations of phytoplankton and oxygen decreased and ammonia increased within the immediate vicinity of schools. (Authors)

16087. Feddern, Henry A. (Marine Lab., Precision Valve Corp., 8737 SW 132 St., Miami, Florida 33156). 1972. FIELD GUIDE TO THE ANGELFISHES (POMACANTHIDAE) IN THE WESTERN ATLANTIC. NOAA Technical Report NMFS CIRC-369, 9 p., illus.

A key illustrated by photographs and brief descriptions is presented to aid in identitying the six species of angelfishes, family Pomacanthidae, found in the western Atlantic. (Auth.)

16088. Tiemeier, Otto, and C. W. Deyoe (Div. of Biol., Kansas State Univ., Manhattan, Kansas). 1972. A REPORT ON FEEDING EXPERIMENTS AT K-STATE. The Catfish Farmer, 4(6): 32-33.

Results are given of 8 years of experimental feeding of channel catfish at Kansas State University.

16089. Burreson, Eugene M., and Ivan Pratt (Oregon State Univ., Mar. Sci. Center, Newport, Oregon). 1972. Trypanosoma pacifica sp. n. FROM THE ENGLISH SOLE Parophrys vetulus Girard FROM OREGON. J. Protozool., 19(4): 555-556.

Trypanosoma pacifica sp. n. is described from the blood of the English sole, Parophrys vetulus Girard, from Oregon. The total length averages 35.9 μm of which 15.4 μm is free flagellum. Comparisons are made with other trypanosomes reported from related species of fishes and with those reported from marine fishes adjacent to North America. (Authors' synopsis)

16090. Thorne, Richard E. (Fish. Res. Inst., Univ. of Wash., Seattle, Washington 98195). 1972. HYDROACOUSTIC ASSESSMENT OF LIMNETIC-FEEDING FISHES. WSG-TA-72-22, Fish. Res. Inst., Univ. of Wash., Seattle, 6 p., 5 figs.; Sea Grant 70's published by Texas A&M Univ., College Station, Texas, 3(4): p. 6.

Hydroacoustic techniques were applied to determine number and biomass of limnetic fishes in order to evaluate their role in the productivity of lake systems. The lakes were surveyed with high frequency, high resolution portable echo sounders. Echo signals were recorded on magnetic tape and analyzed by a special computer program.

16091. Lasenby, D. C., and R. R. Langford (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1972. GROWTH, LIFE HISTORY, AND RESPIRATION OF Mysis relicta IN AN ARCTIC AND TEMPERATE LAKE. J. Fish. Res. Bd. Canada, 29(12): 1701-1708.

Mysis relicta from Char Lake (N. W. T.) take 2 years to reach maturity, retaining 36 cal as net production; those from Stony Lake (southern Ontario) mature in 1 year, retaining 53 cal as net production. Growth rates were highest during summer months for individuals in both lakes. Results of respiration experiments at 0, 2, 4, 6, and 8 C for Char Lake mysids and at 2, 4, 7, 10, and 13 C for Stony Lake mysids were not significantly different, indicating that Mysis relicta demonstrates no metabolic compensation over its environmental temperature range. Generalized energy budgets were constructed for individuals from each population for their entire life-span. A female uses approximately 209 cal for growth and respiration to become a reproducing adult in one year in Stony Lake and approximately 206 cal to become a reproducing adult in 2 years in Char Lake. (Authors)

16092. Iverson, John L. (Div. of Food Technology, FDA, U.S. Health, Education and Welfare, Washington, D. C. 20204). 1972. PERCENT FATTY ACID COMPOSITION AND QUALITY DIFFERENCES OF CHINOOK AND COHO SALMON. Journal of the Assn. of Official Analytical Chemists, 55(6): 1187-1190; Comm. Fish. Abstr., 26(2): p. 21.

During the migration of chinook and coho salmon (from the Pacific Ocean) up the shallow fresh-water streams, the fish do not consume food but use their body reserves. These fish at the time of spawning are in fairly poor condition and quality. Recently artificial propagation practices have made available large quantities of salmon. The captured mature fish are stripped of their roe and the remaining fish are then made available to the market. These "spent" salmon can be canned or otherwise processed and sold without any special label requirements. The present study was undertaken to devise a chemical test, based on composition of the lipid constituents, to distinguish between regular salmon and the so-called spent salmon. During their migration period the salmon utilize fat stored in their tissues for energy and for final development of the roe. Degenerative changes, therefore, take place in their visceral organs and the oil content of the tissues is reduced. It has been suggested that this catabolism results in changes in oil constituents; the long chain monounsaturated fatty acids 20:1 and 22:1 would be utilized before the shorter chain acids and the polyunsaturated acids. Furthermore, there should be a significant change in the relative amounts of the multibranched acids (which are normally present in relatively large amounts in marine oils). The fatty acid profiles of regular (good quality) and spent (poor quality) chinook salmon and coho salmon were determined. The results indicated that the long chain monounsaturated fatty acids seemed to be preferentially utilized by the migrating salmon.

Nevertheless, the author believes that there may be larger generic and specific run variations that preclude the use of a fatty acid compositional approach to differentiate between prime and spent salmon.

16093. De Vlaming, Victor L. (Dept. of Zool., Univ. of Calif., Berkeley, California). 1972. THE EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON REPRODUCTIVE CYCLING IN THE ESTUARINE GOBIID FISH, Gillichthys mirabilis. NOAA Fishery Bulletin, 70(4): 1137-1152.

Investigations were undertaken at several different times during the year to examine the effects of various photoperiods and constant-temperature regimes on reproductive function in the longjaw goby, Gillichthys mirabilis, with the intent of evaluating the influence of these factors in regulation of the annual sexual cycle. Testicular regression occurs at any time during the year when fish are exposed to constant temperature of 24°C and above, independent of photoperiod. Similar results were obtained with female fish, but 22°C is the thermal threshold. It is concluded that the gonadal regression observed in the Alviso population of this species during the summer months is a consequence of increasing temperature. At high temperatures, the transformation of spermatogonia to spermatocytes is blocked, and in females vitellogenesis is inhibited. The degree of gonadal regression is temperature-dependent. Gonadal recrudescence is dependent on low temperatures (10°-20°C) and will not occur if fish are exposed to high temperatures (24°C or above) regardless of photoperiod. At low temperatures, short photoperiods accelerate recrudescence. Between January and June spermatogenesis and oogenesis are maintained at temperatures between 10° and 21°C; long photoperiods are more effective in this respect, but not essential. Regression is not "obligatory" since gonadal involution does not occur at the "normal" time if fish are exposed to temperatures of 20°C or below. (Auth.)

16094. Joy, James E., and Larry P. Jones (Dept. of Vet. Parasitol., College of Vet. Med., Texas A&M Univ., College Station, Texas). 1973. OBSERVATIONS ON THE INFLAMMATORY RESPONSE WITHIN THE DERMIS OF A WHITE BASS, Morone chrysops (Rafinesque), INFECTED WITH Lernaea cruciata (COPEPODA: CALIGIDEA). Journal of Fish Biology, 5(1): 21-23.

Infection of a serranid fish, Morone chrysops, with the adult female 'anchor worm' Lernaea cruciata was accompanied by an inflammatory response characterized by an extensive proliferation of fibrous connective tissue elements. Both the dermis and musculature of the host were involved. No mineralization of tissues was observed. This constitutes the first of L. cruciata from M. chrysops. (Authors)

16095. Hickman, Cleveland P., Jr. (Dept. of Biol., Washington and Lee Univ., Lexington, Virginia). 1972. DETERMINATION OF THE EXTRACELLULAR FLUID VOLUME OF A EURYHALINE FLOUNDER BY KINETIC AND NET RETENTION METHODS USING TRITIUM-LABELED INULIN. Canad. J. Zool., 50(12): 1663-1671.

The extracellular space of 10 euryhaline southern flounder, Paralichthys lethostigma, was determined with methoxy-H^3 inulin. After a single intravenous injection, plasma inulin activity declined in a time-dependent, biphasic manner which could be resolved into two separate rate functions. An initial rapid phase of inulin distribution having an average half-value time of 1.87 h was followed by a slow exponential decline having a half-value time averaging 43.3 h in freshwater-adapted flounder and 119.3 h in marine flounder. The kinetic and net retention space estimates were in close agreement, averaging 15.2% of body weight for freshwater flounder and 16.85% for marine flounder. These figures are consistent with sucrose space estimates of 14.0% for freshwater teleosts and 15.4% for marine teleosts, reported by Thorson (1961). The methoxy-H^3 inulin preparation used was shown to be highly stable and to remain unbound in the circulation. However, it penetrated gradually into a non-exchangeable space in kidney tissue. This undesirable characteristic does not appear to contribute significant error to the extracellular fluid volume (ECFV) estimate. (Auth.)

16096. Page, L. M., and G. S. Whitt (Ill. Nat. Hist. Survey, Urbana, Illinois). 1973. LACTATE DEHYDROGENASE ISOZYMES, MALATE DEHYDROGENASE ISOZYMES AND TETRAZOLIUM OXIDASE MOBILITIES OF DARTERS (ETHEOSTOMATINI). Comp. Biochem. Physiol., 44(2B): 611-623.

Lactate dehydrogenase isozyme patterns were obtained for sixty-seven species of darters, tetrazolium oxidase electrophoretic mobilities for sixty-eight species and malate dehydrogenase isozyme patterns for fifty-seven species. The patterns and mobilities supported previously assumed monophyletic origins for the genera Percina and Etheostoma. Several accepted relationships among darters were supported, and new relationships were suggested. Geographic variation was limited; the most significant variation was the dichotomous nature of the LDH pattern of P. copelandi suggesting that the nominal species may actually consist of two or more taxonomically recognizable forms. (Authors)

16097. Birkhead, William S. (Pamlico Marine Lab., No. Carolina State Univ., Aurora, North Carolina). 1972. TOXICITY OF STINGS OF ARIID AND ICTALURID CATFISHES. Copeia, No. 4, pp. 769-780.

Extracts prepared from the pooled pectoral and dorsal stings and the caudal fins of 12 ictalurid and one ariid catfish were injected into Gambusia affinis. Although it has been generally assumed that madtoms (e.g. Noturus) possessed the most virulent stings as judged by their effects on humans, the more toxic species of catfishes were not necessarily taxonomically related. Extracts from the stings of Ictalurus melas and Noturus exilis were usually lethal to Gambusia, and those from Galeichthys felis, I. natalis, N. gyrinus, N. nocturnus, N. flavus, and N. placidus were quite virulent. Stings of I. punctatus, I. nebulosus, and N. albater were relatively innocuous, and the stings of N. leptacanthus, and Pylodictus olivaris were not considered toxic. An apparent interspecific variation in the virulence of extracts from the caudal fins of these catfishes was best explained in terms of the immune response of the Gambusia. The belief that pectoral stings of catfishes were supplied with venom from the axillary gland is doubted. Although results obtained with I. punctatus and I. melas indicated that this gland was toxic, it was hard to envision how a secretion from it could have been effectively transferred to the sting without becoming greatly diluted. The defensive function attributed to these stings seems apparent from their design. The toxic integumentary sheath is associated with a spine which can inflict a wound into which venom can be extruded. Although the integumentary sheath is damaged in the process, and it appears to regenerate slowly, most of the experimental evidence presented suggests that the toxicity of these stings has developed in response to predation pressure. (Auth.)

16098. Pakkala, I. S., M. N. White, G. E. Burdick, E. J. Harris, and D. J. Lisk (Dept. of Entomol., Cornell Univ., Ithaca, New York). 1972. RESIDUES IN FISH, WILDLIFE, AND ESTUARIES. A SURVEY OF THE LEAD CONTENT OF FISH FROM 49 NEW YORK STATE WATERS. Pesticides Monitoring Journal, 5(4): 348-355; Selected Water Resources Abstracts, 5(24): p. 65.

A survey was made of 419 fish in 49 New York State waters for total lead content and compared to data presented on a series of lake trout sampled in 1970 from Cayuga Lake in order to determine if lead were cumulative in these fish. Lead content was determined by dry ashing 10 gm of fish at 485 degrees C and examining the residue by a colorimetric procedure. The results showed that lead concentrations usually ranged from 0.3 to 1.5 ppm, and a few samples up to 3.0 ppm. Variations were found in lead content of fish taken from different lakes, but no correlation was observed between lead concentration and size, species, or sex. Lead did not appear to be cumulative in lake trout up to 12 years of age taken from Cayuga Lake.

16099. Robertson, D. A., and U. Raj (Portobello Marine Biol. Sta., Univ. of Otago, Dunedin, New Zealand). 1971. EGG AND YOLK SAC STAGES OF THE SAND FLOUNDER (TELEOSTEI: PLEURONECTIDAE). Reprint from N. Z. Journal of Marine and Freshwater Research, 5(3, 4): 404-414.

The developmental stages of the eggs and yolk-sac larvae of the common sand flounder, Rhombosolea plebeia (Richardson), are described and illustrated. (Authors)

16100. Scalet, Charles G. (Dept. of Zool., Univ. of Oklahoma, Norman, Okla.). 1973. REPRODUCTION OF THE ORANGEBELLY DARTER, Etheostoma radiosum cyanorum (OSTEICHTHYES: PERCIDAE). Amer. Midl. Nat., 89(1): 156-165.

The orangebelly darter, Etheostoma radiosum cyanorum, reaches sexual maturity and spawns when 1 year old. Numerous sexually dimorphic traits are exhibited by the fish, including body size and coloration; anal papillae size, shape and pigmentation; and the presence of breeding tubercles. Gonadal development is at its lowest point in September and reaches its peak in March, April and May. At the peak of gonadal development the ovaries of the females constitute approximately 10-15% of the body weight. The fecundity of the fish is quite low. Spawning occurs mainly between the middle of March and the middle of April. The darters select areas of small diam (3-5 mm) gravel as spawning sites. These sites are located in the moderate current portions of the raceway sections of the stream. Courtship behavior follows the entry of the female into the spawning area. If receptive to the male, she then initiates the actual spawning act by rising off the stream bottom and diving headlong into the gravel in an attempt to bury herself. If successful, the female fans the gravel partially away from herself. The male mounts and the spawning act, which lasts approximately 2-5 sec, begins. During this period, numerous other fish species can be in close proximity to the darters without disturbing their spawning activities. (Auth.)

16101. Carr, William E. S., and Clayton A. Adams (Dept. of Zool., Univ. of Florida, Gainesville, Florida 32601). 1972. FOOD HABITS OF JUVENILE MARINE FISHES: EVIDENCE OF THE CLEANING HABIT IN THE LEATHERJACKET, Oligoplites saurus, AND THE SPOTTAIL PINFISH, Diplodus holbrooki. NOAA Fishery Bulletin, 70(4): 1111-1120.

Quantitative gravimetric analyses of stomach contents of juvenile leatherjacket, Oligoplites saurus, and spottail pinfish, Diplodus holbrooki, have revealed that both species pass through a stage in which they clean ectoparasites from other fishes. This cleaning stage is most evident in juveniles between 26 and 40 mm standard length and is far less evident among juveniles of larger or smaller size. These findings represent the first report that cleaning is practiced by either species and the first quantitative data on the significance of the cleaning habit to members of the Family Carangidae and Family Sparidae. Neither O. saurus nor D. holbrooki depend exclusively on cleaning as a source of food. Juveniles of O. saurus feed heavily on plankton and small shrimp whereas juveniles of D. holbrooki feed heavily on epiphytic algae, plankton, and encrusting organisms. Juveniles of both species exhibit distinct changes in diet during growth. (Authors)

16102. Williams, Ernest H., Jr., and Wilmer A. Rogers (Dept. of Fish. and Allied Aquaculture, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1972. Isoglaridacris agminis sp. n. (CESTODA: CARYOPHYLLAEIDAE) FROM THE LAKE CHUBSUCKER, Erimyzon sucetta (Lacépède). J. Parasit., 58(6): 1082-1084.

A caryophyllaeid cestode, Isoglaridacris agminis sp. n., is described from the lake chubsucker, Erimyzon sucetta (Lacépède). A low number of testes occurring in one dorsal and one ventral row separates I. agminis from others of the genus. A table comparing the species of Isoglaridacris is presented. (Authors)

16103. Gentle, Michael J. (Zool. Dept., Bedford College, Regent's Park, London, England). 1972. THE EYE AND COLOUR CHANGE IN THE MINNOW (Phoxinus phoxinus L.). J. Exp. Biol., 57(3): 701-707.

Counts were made of the retinal receptors and observations were made of the colour of the minnow, Phoxinus phoxinus L., following the surgical removal of parts of the dorsal and ventral retina. It was found that there were greater numbers of retinal receptors in the temporal field than in the rostral field of the eye. There were very few triple and quadruple cones but a large number of double and single cones in the ventral retina compared to the dorsal. Surgical removal of the dorsal retina or only part of it resulted in the fish being fully dark-adapted on a black or white background. Surgical removal of the ventral retina resulted in the fish assuming an intermediate colour on a white background and a darker tint on a black background. (Auth. summ.)

16104. Aoki, Takashi, Syuzo Egusa, Takahisa Kimura, and Tsutomu Watanabe (Dept. Fish., Univ. of Tokyo, Tokyo, Japan). 1971. DETECTION OF R FACTORS IN NATURALLY OCCURRING Aeromonas salmonicida STRAINS. Applied Microbiology, 22(4): 716-717; Fish Health News prepared by Eastern Fish Disease Lab., 2(1): p. 9.

Resistance factors (R factors) were detected in 3 strains of Aeromonas salmonicida. Strains of A. salmonicida with R factors are capable of transferring these factors to other bacteria, thus proving drug resistant forms. Transfer of drug resistance factors has significance in the chemotherapeutic procedure used for bacterial diseases of fishes and humans. -- G. L. Bullock

16105. Hara, Toshiaki J. (Dept. of Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1973. OLFACTORY RESPONSES TO AMINO ACIDS IN RAINBOW TROUT, Salmo gairdneri. Comp. Biochem. Physiol., 44(2A): 407-416.

The olfactory bulbar responses induced when the nares were infused with solutions of amino acids and related compounds were studied in rainbow trout, Salmo gairdneri. The order of magnitude of the response to the eleven most effective of 49 amino acids tested were: L-glutamine > L-methionine > L-leucine > homoserine > L-asparagine > L-alanine > L-cystine > L-cysteine > glycine > L-serine > L-histidine. The threshold concentrations were estimated to range between 10^{-7} and 10^{-8} M for those most effective amino acids. The L-isomer of an amino acid was always more effective than its D-isomer. The correlation between stimulatory effectiveness of amino acids and their molecular structure is discussed. (Auth.)

16106. Adams, A. E., and V. Titoko. 1970. A PROGRESS REPORT ON THE INTRODUCTION OF GRASS CARP (Ctenopharyngodon idella) IN FIJI. Fiji Agric. Journal, 32(2): 43-46; Weed Abstracts, 21(2), 1972.

Four ponds were constructed in July 1968 and Hydrilla verticillata, a problem water weed in Fiji, was introduced. About 170 fingerlings of grass carp (with an average individual weight of 6.5 g) were put into the largest pond (1/7 acre) in December; the H. verticillata was cleared within 20 days and fresh supplies had to be brought in from the Rewa River. The feeding rate of the grass carp altogether was about 121 lb H. verticillata (drained weight)/day. The weight gain over the first 6 months averaged 0.55 g/fish and over the first 12 months, 6 g/fish, higher than that recorded elsewhere.

16107. Harris, G. S. (Dept. of Zool., Univ. of Liverpool, England). 1973. A SIMPLE EGG BOX PLANTING TECHNIQUE FOR ESTIMATING THE SURVIVAL OF EGGS DEPOSITED IN STREAM GRAVEL. J. Fish Biol., 5(1): 85-88.

A simple technique for estimating the survival of eggs during their incubation in stream gravels by planting eggs in specially designed boxes is described. This technique ensures that all the live eggs and alevins present in the gravel at the time of sampling can be recovered. Survival can be calculated accurately from the ratio of the number of live recovered to the number of eggs originally planted and the errors caused by the loss of dead eggs and escape of live alevins from the sample area are avoided. (Auth.)

16108. Smith, Charlie E., Jamieson E. Holway, and Glen L. Hammer (Fish Cult. Devel. Center, Bozeman, Montana). 1973. SULPHAMERAZINE TOXICITY IN CUT-THROAT TROUT BROODFISH Salmo clarki (Richardson). J. Fish Biol., 5(1): 97-101.

Treatment of cut-throat trout broodfish Salmo clarki (Richardson) with sulphamerazine at 220 mg/kg (10 g/100 lb) of fish/day for 14 days resulted in severe kidney histopathology and increased mortality among males. Experimental data presented showed that cut-throat trout broodfish were extremely sensitive to sulphamerazine toxicity. Hydropic degeneration of renal tubule epithelium and haemorrhage into tubule lumens were observed in kidneys of both male and female trout, but was more severe in the former. Death, which occurred only in males, was correlated with spawning stress and impaired renal function. (Authors)

16109. McCarthy, James J., and Daniel Kamykowski (Inst. of Mar. Resources, Univ. of Calif., San Diego, La Jolla, California 92037). 1972. UREA AND OTHER NITROGENOUS NUTRIENTS IN LA JOLLA BAY DURING FEBRUARY, MARCH, AND APRIL 1970. NOAA Fishery Bulletin, 70(4): 1261-1274.

Samples collected from La Jolla Bay twice weekly for 2-1/2 months were analyzed for nitrate, nitrite, ammonium, and urea in addition to other chemical, physical, and biological parameters. On the basis of an infestation of blue sharks (Prionace glauca), periods before, during, and after the infestation were defined. Statistical analyses indicated that: 1) Urea concentrations were highest during the period of shark infestation. 2) There was strong positive correlation between phaeo-pigment/chlorophyll ratios and ammonium concentrations during the infestation but none between the pigment ratios and either the ammonium concentrations for the other two periods or the urea concentrations for any of the three periods. 3) There was no correlation between ammonium and urea concentrations before, a strong positive correlation during, and no correlation after the shark infestation. 4) Urea was the only nitrogenous nutrient for which the concentrations above and below the thermocline were not different. 5) Comparisons between two stations 1.5 km distant indicate that on a horizontal scale, the patch structure for urea is smaller than that of the other nitrogenous nutrients although the median urea concentration in the water column was not different at the two stations. The temporal similarity and the more complex patch structure for urea (as seen in 4 and 5 above) suggest that the blue sharks were responsible for the higher urea concentrations during the infestation. Although the median ammonium concentrations before and during the infestation were not different, the strong positive correlation between ammonium and urea concentrations during the infestation hint that the sources or rates of supply and utilization for both nutrients may have been closely related. The strong positive correlation between phaeo-pigment/chlorophyll ratios and ammonium concentrations during the infestation may imply that the source of ammonium was herbivore excretion. (Authors)

16110. Fontaine, Y. A., C. Salmon, E. Fontaine-Bertrand, E. Burzawa-Gerard, and E. M. Donaldson (Lab. de Physiol. gen. et comp., Paris, France). 1972. COMPARISON OF THE ACTIVITIES OF TWO PURIFIED FISH GONADOTROPINS ON ADENYL CYCLASE ACTIVITY IN THE GOLDFISH OVARY. Canad. J. Zool., 50(12): 1673-1676.

The pituitary gonadotropin from a Pacific salmon (Oncorhynchus tshawytscha) stimulates adenyl cyclase activity in homogenates of ovaries from goldfish (Carassius auratus) but it is about 36 times less active than carp (Cyprinus carpio) gonadotropin. Moreover, a higher maximal stimulation of the cyclase is obtained with the more homologous (carp) gonadotropin. These results suggest the existence of a partial zoological specificity of teleost gonadotropins in their stimulating action on adenyl cyclase. (Authors)

16111. Snelson, Franklin F., Jr. (Dept. of Biol. Sci., Fla. Technol. Univ., Orlando, Florida). 1973. SYSTEMATICS AND DISTRIBUTION OF THE RIBBON SHINER, Notropis fumeus (CYPRINIDAE), FROM THE CENTRAL UNITED STATES. Amer. Midl. Nat., 89(1): 166-191.

Notropis fumeus (subgenus Lythrurus) is widely distributed in low lying areas from the Gulf slope of Texas N through the Mississippi River system to southern Illinois and Indiana. The species is redescribed and illustrated and its nomenclature is discussed. Except for breeding tuberculation, geographic variation is minimal and no races are recognized. Features for distinguishing N. fumeus from N. umbratilis and other related species are discussed. A small shiner from Red River tributaries in the Ouachita Mountains has been incorrectly associated with N. fumeus. (Auth.)

16112. Hubbs, Clark, and Dale F. Burnside (Dept. of Zool., The Univ. of Texas, Austin, Texas). DEVELOPMENTAL SEQUENCES OF Zygonectes notatus AT SEVERAL TEMPERATURES. Copeia No. 4, pp. 862-865.

16113. Karppanen, E., and K. Henriksson. 1971. DDT AND PCB IN FISH. Suom Elainlaakaril, 77(12): 429-437, illus., English summ.; Selected Water Resources Abstracts, 5(24): p. 71.

DDT and PCB (polychlorinated biphenyls) determinations made from various species of fish are presented. The material consisted of 136 samples of fish, from various sites in the Gulfs of Finland and Bothnia and from lake waters in different parts of Finland. Besides some background contamination observable in certain 'clean' waters, a slightly increased content of DDT and PCB was encountered in material from the bays of the Baltic. Increases in the DDT content in occasional lake systems probably depend on an earlier practice of treating timber with DDT compounds, nowadays prohibited. Relatively high contents of PCB received at the mouth of the Kokemaki River called for a closer study of the material from the Tampere area, where among other industries, a condenser factory which uses PCB is located. A marked increase of the PCB content was observed in samples from waters below the industrial areas of Tampere and Nokia. Gas chromatographic analyses revealed, besides the known peaks of technical PCB-compounds used by the industry and which contain 50-60% and 42% chlorine, the presence of other PCB. The occurrence of different known and unknown PCB compounds and their possible transformation is discussed. A control of PCB outlets in the waters is called for and the danger of such outlets in connection with the destruction of small condensers from household appliances like refrigerators and washing machines is stressed. -- Copyright 1972, Biological Abstracts, Inc.

16114. Roberts, M. G., D. E. Wright, and G. E. Savage (Dept. of Zool and Comp. Physiol., Queen Mary College, London, England). 1973. A TECHNIQUE FOR OBTAINING THE ELECTROCARDIOGRAM OF FISH. Comp. Biochem. Physiol., 44(2A): 665-668.

A method is described which enables the electrocardiogram of a fish to be studied over extended periods using chronically implanted electrodes. This method has been used successfully for studies on restrained and free-swimming fish, and is particularly suited for use with underwater radio telemetry. (Authors)

16115. Aoki, Takashi, Syuzo Egusa, Chiyo Yada, and Tsutomu Watanabe. 1972. STUDIES OF DRUG RESISTANCE AND R FACTORS IN BACTERIA FROM POND-CULTURED SALMONIDS. I. AMAGO (Oncorhynchus rhodurus macrostomus) AND YAMAME (Oncorhynchus masou ishikawae). Japan J. Microbiol., 16(3): 233-238; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 9.

Considerable fractions of gram-negative bacilli, Aeromonas liquefaciens, A. salmonicida, Pseudomonas, Hafnia and unidentified Enterobacteriaceae, isolated from the intestinal tracts of cultured Amago (Oncorhynchus rhodurus macrostomus) from 23 Amago-ponds and of Yamame (O. masou ishikawae) from one pond as well as the water of 3 ponds in Shiga, Gifu and Nagano Prefectures and Tokyo Metropolis in Japan were found to be multiple-drug-resistant. Of these, A. salmonicida and A. liquefaciens carried R factors at high frequencies and were prevalent in many Amago ponds throughout Japan. (Authors' summ.)

16116. Pandey, S., and W. S. Hoar (Dept. of Zool., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1972. INDUCTION OF OVULATION IN GOLDFISH BY CLOMIPHENE CITRATE. Canad. J. Zool., 50(12): 1679-1680.

Clomiphene citrate induced ovulation in gravid goldfish. The stripped eggs were viable and on fertilization developed into normal fry. (Authors)

16117. Walker, M. Greer, and G. Pull (Ministry of Agric., Fish. and Food, Fish. Lab., Lowestoft, England). 1973. SKELETAL MUSCLE FUNCTION AND SUSTAINED SWIMMING SPEEDS IN THE COALFISH Gadus virens L. Comp. Biochem. Physiol., 44(2A): 495-501.

The function of red and white skeletal muscle fibers of the coalfish (Gadus virens L.) is described at sustained swimming speeds of up to 3 fish lengths per sec (L/S) by training fish and measuring the resulting muscle fiber hypertrophy. Above 1 L/S the relation between fiber hypertrophy and swimming velocity is given for the red fibers by $Y = 20.80x + 120.00$ and for the white fibers by $Y = 72.81x - 72.90$. (Authors)

16118. Rosenthal, H. (Biologische Anstalt Helgoland, West Germany). 1971. EFFECTS OF 'RED MUD' ON EMBRYOS AND LARVAE OF THE HERRING Clupea harengus. (Wirkungen von 'rotschlamm' auf embryonen und larven des herings Clupea harengus). Helgolander Wissenschaftliche Meeresuntersuchungen, Hamburg, 22(3-4): 366-376; Selected Water Resources Abstracts, 5(24): p. 74.

In aluminum production, treatment with water dissolves the aluminum, but iron remains undissolved as ferric hydroxide or red mud. The biological effects of red mud, soon to be released into the North Sea in large quantities, on herring eggs and larvae from Baltic spring spawners were tested. Eggs were artificially fertilized and incubated in 1 liter aerated containers. The addition of red mud reduced percentages of survival to about 40-50%. The red mud particles adhered to the eggshells, forming an almost regular layer, thereby interfering with gaseous and other exchanges between eggs and surrounding medium. Speed of development was retarded and a number of embryonic malformations increased with increasing concentrations. Many larvae absorbed red mud particles blocking their food intake.

16119. Wanson, Warren W., and Omer R. Larson (Dept. of Biol., Univ. of No. Dakota, Grand Forks, North Dakota). 1972. STUDIES ON HELMINTHS OF NORTH DAKOTA. V. LIFE HISTORY OF Phyllodistomum nocomis Fischthal, 1942 (TREMATODA: GORGODERIDAE). J. Parasit., 58(6): 1106-1109.

Sporocysts and cercariae develop inside the gills of the fingernail clam, Sphaerium striatinum, and cercariae encyst within their daughter sporocysts. Metacercariae fed to 4 species of minnows were recovered as immature worms from kidney ducts and urinary bladders of all 4 species. Only in hornyhead chubs (Hybopsis biguttata) did worms mature into egg-bearing adults. This definitive host acquires the parasite by eating infected clams. (Authors)

16120. Gentle, Michael J. (Zool. Dept., Bedford College, Regent's Park, London, England). 1972. A NOTE ON THE PALING CENTRE OF THE MINNOW (Phoxinus phoxinus L.). Journal of Experimental Biology, 57(3): 709-711.

The degeneration of the tectal efferent fibres was studied using the paraffin Nauta technique following lesion to the optic tectum in Phoxinus phoxinus L. A degenerating fibre bundle of the tractus tecto-bulbaris ventralis rectus was found to end in a group of neurones in the anterior medulla. (Auth. summ.)

16121. Delisle, Claude E. (Aquarium de Montreal, La Ronde, Ile Ste-Helene, Montreal, Quebec, Canada). 1972. MONTHLY VARIATIONS OF Glugea hertwigi (SPOROZOA: MICROSPORIDA) IN DIFFERENT TISSUES AND ORGANS OF THE ADULT FRESHWATER SMELT AND CONSEQUENCES OF THIS INFECTION ON A MASSIVE ANNUAL MORTALITY OF THIS FISH. [Variations mensuelles de Glugea hertwigi (Sporozoa: Microsporida) chez differents tissus et organes de l'eperlan adulte dulcicole et consequences du cette infection sur une mortalite massive annuelle de ce poisson]. Canad. J. Zool., 50(12): 1589-1600.

From September 1964 to September 1965, twelve hundred autopsies were performed at a rate of one hundred per month on the adult stunted population of freshwater smelts Osmerus eperlanus mordax of Heney Lake, Gatineau County, Quebec. It is shown that the digestive tract is really the primary site of infection by Glugea hertwigi. Levels of infection are given separately for the anterior, mid, and posterior part of the intestine, for the pyloric ceca, the esophagus, the stomach layers, the anal region, the liver, the male and female gonads, the peritoneum, the air bladder, the adipose tissue, the heart, and kidneys. Glugea cysts in the head, trunk and fin regions were also counted. An increase from 53% to 76% in the general rate of infection happened during the spring (May and June). Since 1960, a mass mortality occurred every spring, in mid-May, and killed around 10 million smelts each year. It is proposed that all organs are susceptible to invasion by Glugea spores and that spring and summer warm water temperature had a positive effect on schizogony and sporogony of Glugea leading to a general infection of the host. It is believed that physiological exhaustion of the adult smelts during spawning time, together with Glugea, is responsible for the massive spring kill. (Auth.)

16122. Vladykov, V. D. (Dept. of Biol., Univ. of Ottawa, Ottawa, Ontario, Canada). 1972. MORPHOLOGICAL DIFFERENCES IN MALE GONADS AMONG NINE GENERA OF GADIDAE (PISCES). J. Fish. Res. Bd. Canada, 29(12): 1709-1716.

Among 12 species of Gadidae, which belong to nine genera and three subfamilies, six basic types of male gonads are observed. In the freshwater genus, Lota, gonads are simple, nearly cylindrical in shape, and not dubdivided into lobes. In the marine genera of cold waters, such as Melanogrammus and Gadus, the other extreme in gonad structure, consisting of numerous, rather uniform convolutions, is found. In the marine genera Urophycis and Merluccius of more temperate waters, the male gonads consist of several lobes, rather irregular in shape and size. Among genera inhabiting brackish and sometimes fresh water, such as Microgadus, Boreogadus, and Eleginus, the gonads are subdivided into lobes which are not very numerous. In the genus Arctogadus, distributed in salt and brackish Arctic waters, the gonads are intermediate in their complexity between the typical marine genera of cold water, Melanogrammus and Gadus, and those three genera inhabiting brackish waters. The explanation for the morphological differences in male gonads of Gadidae appears to be associated principally with the respective type of waters (salt or fresh) which they inhabit and their spawning requirements, and to a much lesser degree with their systematic relationships. (Auth.)

16123. Skare, I. (Dept. of Chem., Arbetsmedicinska Inst., Stockholm, Sweden). 1972. MICRODETERMINATION OF MERCURY IN BIOLOGICAL SAMPLES. PART III. AUTOMATED DETERMINATION OF MERCURY IN URINE, FISH AND BLOOD SAMPLES. Analyst, 97(1151): 148-155; Selected Water Resources Abstracts, 6(1): p. 43.

Use of the automatic mercury analyzer has been extended to mercury analyses of urine, fish, and blood samples. Sulphamic acid and Triton X-100 detergent are added to urine samples prior to analysis in order to prevent bacterial action. Wet-digestion of blood and fish samples must be performed prior to mercury analysis. With the standard procedures recommended it is possible to determine mercury concentration in blood down to about the normal values for unexposed persons, i.e., about 5 ng/g, and mercury in fish down to the 0.1 microgram/gram level, with an acceptable standard error. Comparative studies between this method and the methods of activation analysis and gas chromatography have shown good agreement. This method is applicable to all types of samples that can be digested similarly to those above. Natural water samples, normally too low in mercury to be analyzed directly (i.e., less than 0.1 ng/ml), could easily be concentrated by tin (II) reduction of a larger permanganate-digested sample, followed by the passing of the mercury vapor into a 2-ml volume of dilute acidic permanganate solution. The detection limit by this technique would depend only on the level of mercury in the reagent blank.

16124. Prather, S. H., and R. M. Sorensen. 1972. A FIELD INVESTIGATION OF ROLLOVER FISH PASS, BOLIVAR PENINSULA, TEXAS. TAMU-SG-72-202, Texas A&M Univ. Sea Grant Program, College Sta., Texas; Sea Grant 70's, 3(4): p. 7.

Field study of artificial tidal inlet connecting Galveston East Bay, Texas, with the Gulf of Mexico is described. Objectives were to, 1) evaluate the flow and stability characteristics of the inlet, 2) investigate the propagation of the tidal wave through the connected bay system and 3) evaluate the effect of the inlet on tidal fluctuations and flushing of East Bay. Field work included hydrographic surveys of the inlet and adjacent Gulf beaches, collection and analysis of sediment samples from the inlet and beaches, measurement of tidal fluctuations at selected locations in East Bay, and current measurements in the inlet. Tidal data provided by the Galveston District Corps of Engineers were analyzed with the field data.

16125. Horn, Michael H. (Dept. of Biol., Calif. State Univ., Fullerton, Calif. 92634). 1972. THE AMOUNT OF SPACE AVAILABLE FOR MARINE AND FRESHWATER FISHES. NOAA Fishery Bulletin, 70(4): 1295-1297.

16126. Bremer, H., and P. Ernst (Sektion Biologie/Chemie des Pädagogischen Instituts Güstrow). 1972. A CONTRIBUTION TO THE ONCOLOGY OF THE CAULIFLOWER TUMOR OF Anguilla anguilla. (Ein Beitrag zur Onkologie der Blumenkohlgeschwülste bei Anguilla anguilla.) Z. Binnenfischerei DDR, 19(6): 167-176; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 10.

1. The cauliflower tumor of Anguilla anguilla is a fibroepithelial papilloma. It originates from a folding of the epidermis and a narrow region of the corium. 2. Nuclei and cells of the basal layer are significantly enlarged. The cause is seen to lie in an endomitotic process. 3. Considering the cell differentiation, there is a difference from healthy epidermis of eels. (Authors' summ. translated).

This is an histologic report on the so-called cauliflower disease of eels. The work is well illustrated though reproduction of the figures is not good. Newer references on this disease are not in the literature review. -- Ken Wolf.

16127. Miller, A., III, R. A. Scanlan, J. S. Lee, and L. M. Libbey (Dept. of Food Sci. and Technology, Oregon State Univ., Corvallis, Oregon). 1972. QUANTITATIVE AND SELECTIVE GAS CHROMATOGRAPHIC ANALYSIS OF DIMETHYL AND TRIMETHYLAMINE IN FISH. Journal of Agric. and Food Chemistry, 20(3): 709-711; Selected Water Resources Abstracts, 6(1): p. 38.

The selective gas chromatographic separation of methylamines was accomplished using columns containing Graphon and tetraethylenepentamine with an alkali flame ionization detector (AFID). Trimethylamine (TMA, 10 ppm) and dimethylamine (DMA, 50 ppm) added to fish were easily detected by equilibrium vapor analysis. Greater sensitivity (25 ppb TMA and 100 ppb DMA) was obtained by using the AFID in conjunction with a gas entrainment, on-column trapping procedure. The method is also useful for the analysis of other food products and biological materials.

16128. Olson, Andrew C., Jr. (Dept. of Zool., Calif. State Univ., San Diego, California). Argulus melanostictus AND OTHER PARASITIC CRUSTACEANS ON THE CALIFORNIA GRUNION, Leuresthes tenuis (OSTEICHTHYES: ATHERINIDAE). J. Parasit., 58(6): 1201-1204.

Grunion from southern California and Baja California, Mexico, were hosts for 6 crustaceans: the copepods Bomolachus pectinatus, Caligus olsoni, and Clavellopsis sp.; the branchiuran Argulus melanostictus; and the isopods Nerocila californica and Lironeca californica. Clavellopsis, Argulus, Nerocila, and Lironeca are new host records. For A. melanostictus this is the first host record, a new distribution, and the first description of the male. (Auth.)

16129. MacKinnon, J. C. (Fish. Res. Bd. of Canada, Marine Ecol. Lab., Bedford Inst., Dartmouth, N. S. and Dalhousie Inst. of Oceanogr., Halifax, Nova Scotia, Canada). 1972. SUMMER STORAGE OF ENERGY AND ITS USE FOR WINTER METABOLISM AND GONAD MATURATION IN AMERICAN PLAICE (Hippoglossoides platessoides). J. Fish. Res. Bd. Canada, 29(12): 1749-1759.

American plaice (Hippoglossoides platessoides) in St. Margaret's Bay, Nova Scotia, had an annual energy storage cycle in which a mature 35 cm female stored 92 kcal during the summer period and used this energy for metabolism (72 kcal) and gonad maturation (20 kcal) in winter months. An additional 21 kcal was stored in the ovary during the summer period. These energy changes occurred in a fish with a total energy content of approximately 300 kcal and an annual energy increment of 51 kcal due to growth in length. The annual energy variation in immature females and males was less than in mature females. A comparison of summer production (143 kcal, excluding gonad energy) with net annual production (51 kcal) for a 35 cm female plaice indicated that higher yields would be obtained by harvesting at the end of the summer period than by taking the same fish at the end of the overwintering period. (Auth.)

16130. Werner, Robert G. (State Univ. Coll. of Forestry, Syracuse Univ., Syracuse, New York). 1972. BLUESPOTTED SUNFISH, Enneacanthus gloriosus, IN THE LAKE ONTARIO DRAINAGE, NEW YORK. Copeia No. 4, p. 878.

16131. Frank, P. A. (USDA, Denver Federal Center, Colorado). 1970. BEHAVIOUR OF EMULSIFIED XYLENE IN WATER. Abstracts of the Meeting of the Weed Science Society of America, 134; Weed Abstracts, 21(2): p. 175, Abstr. 1082, 1972.

The stability of similar xylene emulsions varied widely among different canals. Rates of xylene loss from flowing water varied from about 90% at 3 miles downstream from the point of application in one canal to 78% at 10 miles downstream in another. Water quality did not appear to be a major factor affecting the reduction in levels of xylene. Low water temperatures were observed by other workers to reduce the effectiveness of xylene as a herbicide. However, the persistence of xylene was both good and poor in water of 12 to 13°C. Canal characteristics such as water checks and turbulent pools were associated with high loss rates. Trout were more sensitive than bluegill to the xylene emulsion when placed in cages in two treated canals, but both fish species were quickly killed at distances of 9 and 10 miles downstream from the point of application.

16132. Taber, Charles A., and Robert F. Wilkinson, Jr. (Dept. of Life Sci., Southwest Missouri State Coll., Springfield, Missouri). 1973. Etheostoma nianguae IN THE SAC RIVER DRAINAGE, MISSOURI. Amer. Midl. Nat., 89(1): 251-252.

Collections of the Niagua darter, Etheostoma nianguae, in a tributary of the Little Sac River in Missouri represent an increase in the known range of this rare species. (Authors)

16133. Kloth, T. C., and D. E. Wohlschlag (Inst. of Mar. Sci., Texas Univ., Port Aransas, Texas). 1972. SIZE-RELATED METABOLIC RESPONSES OF THE PINFISH Lagodon rhomboides, TO SALINITY VARIATIONS AND SUB-LETHAL PETROCHEMICAL POLLUTION. Contributions in Marine Science, 16: 125-137; Selected Water Resources Abstracts, 5(24): p. 74.

The effects of salinity variations on the respiratory metabolism of large and small pinfish in unpolluted water and in water slightly polluted with a 0.5% petrochemical effluent were investigated at near saturation dissolved oxygen levels and at a near optimum temperature of 20 C. A salinity range of 20-45 ppt did not significantly affect the respiratory metabolism of large or small pinfish in unpolluted water. However, sustained swimming velocities were found at 20 ppt, for both large and small pinfish, and the velocities decreased as salinity increased. Sustained swimming velocities of large pinfish decreased more than those of small pinfish. Sublethal pollution uniformly depressed small fish metabolism at all salinities. With large pinfish, pollution depressed metabolism at 20 and 32 ppt, but elevated metabolism at 45 ppt. Multiple regression analysis showed that salinity had a statistically significant effect on respiration only with large pinfish in polluted water.

16134. Dempster, P. Robert (Steinhart Aquarium, San Francisco, California). 1970. A DESCRIPTION OF THE METHOD USED TO DETERMINE THE PRESENCE OF CHLORITE IN WATER WHEN SODIUM CHLORITE IS ADDED TO A FISH TANK OR LARGE WATER SYSTEM. Anchor, 14(10): 338-341; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 11.

The title is self explanatory. Louis Garibaldi of the New England Aquarium has made the following statements concerning this chemical: sodium chlorite is being used with increasing frequency in closed systems such as aquariums. Within a wide range of concentrations it has proven non-toxic to fishes and higher vertebrates. At low concentrations (2.0-5.0 ppm), sodium chlorite seems to limit bacterial, fungal and possibly protozoan populations, improves the clarity of water, inhibits the growth of algae to some extent and at the same time does not destroy saprophytes, thus permitting a biological equilibrium to establish itself. -- Monte Millard.

16135. Filon, V. V. (Upper Volga Div., State Inst. for Fish. (GosNIORKh), Konakovo, USSR). 1971. INCREASE IN THE TEMPERATURE AT WHICH ROACH, PERCH, AND RUDD SURVIVE IN THE WARM WATERS FROM THE KONAKOVO HYDROELECTRIC POWER STATION. Hydrobiological Journal, 7(4): 69-72.

16136. Wong, Brian, and F. J. Ward (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1972. SIZE SELECTION OF Daphnia pulicaria BY YELLOW PERCH (Perca flavescens) FRY IN WEST BLUE LAKE, MANITOBA. J. Fish. Res. Bd. Canada, 29(12): 1761-1764.

Prior to mid-July, Daphnia pulicaria in yellow perch (Perca flavescens) fry stomachs were smaller than those in plankton collections but after this date mean lengths of D. pulicaria in stomachs and collections were similar indicating an initial selection for small D. pulicaria by the fish. The relation between D. pulicaria body depth and perch mouth gape width indicated that perch fry less than 18 mm long, a length attained in mid-July, could not readily ingest D. pulicaria with body depths greater than 0.7 mm (1.3 mm long). The heterogonic relation between growth in mouth and body size enabled perch fry in West Blue Lake to quickly utilize, as an energy source, the abundant D. pulicaria population. (Authors)

16137. de Kinkelin, P. (Lab. d'Ichtyopathologie, Station de Virol. et d'Immunol., I.N.R.A., 78-Thiverval-Grignon, France). 1972. THE EGTVED VIRUS. II. PURIFICATION. (Le virus d'egtved. II. - Purification). Ann Rech. veter., 3(2): 199-208; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 12.

Virus with C^{14} labelled proteins was profuced in an FHM cell-line. Concentration was achieved by addition of 7 p. 100 Carbowax 6000, followed by centrifugation for 30 mn at 10,000 g. After desalting on Sephadex G^{25}, the virus was purified by centrifugation at 80,000 g for 3-1/2 hours on a 15-45 p. 100 linear sucrose gradient concentration and the infective peak was found equilibrated in the 32-34 p. 100 fraction. Carbowax concentration is a mild process, particularly necessary in the case of Egtved virus and extendable to other enveloped viruses of fish: Infectious haematopoietic necrosis virus and Infectious dropsy virus. (Auth. summ.)

The report describes procedures for dialysis concentration of Egtved virus using polyethylene glycol. Desalting and centrifugation on linear sucrose gradients completed the preparation of virus. Applications are appropriate for antigen and other uses where concentrated virus is essential. Though not commented upon, two bands obtained in gradient centrifugation of Egtved have their origin in: 1, released virus and, 2, cell-associated virus. In generalization, viruses taken from the former are intially less contaminated with cellular material. -- Ken Wolf

16138. Schulz, D. (Inst. Vet.-Path., Freie Univ., Berlin, West Germany). 1970. STUDIES ON THE SIDE EFFECTS OF THE HERBICIDE NaTA (Na-TRICHLOROACETATE) ON CARP. PART 2: THE VENTRAL ABDOMINAL WALL. Berliner und Münchener Tierärztliche Wochenschrift, 83(3): 256-264; Weed Abstracts, 21(3): p. 253, Abstr. 1556.

Carp exposed to NaTA (TCA sodium) at concentrations of 7, 70 and 700 ppm showed distinct colour change, in addition to the loss of weight and respiratory disturbance reported in Weed Abstr. 20:920. Skin epithelium of the ventral abdominal wall displayed necrobiosis, necrosis and degenerative atrophy, which, in the case of fish treated with the highest concentration, was accompanied by myolysis.

16139. Higgs, D. A., and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1973. MEASUREMENT OF CIRCULATING THYROXINE IN SEVERAL FRESHWATER TELEOSTS BY COMPETITIVE BINDING ANALYSIS. Canad. J. Zool., 51(1): 49-53.

A competitive binding analysis using human thyroxine-binding globulin (TBG) and Sephadex columns was the most satisfactory of several methods tested for measuring fish plasma thyroxine concentrations. Thyroxine levels were usually less than 1 μg and in most cases less than 0.5 μg per 100 ml plasma for laboratory-held brook trout and nine other freshwater species. (Authors)

16140. Schreck, Carl B., Robert T. Lackey, and M. Lloyd Hopwood (Colorado Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado). 1972. EVALUATION OF DIEL VARIATION IN ANDROGEN LEVELS OF RAINBOW TROUT, Salmo gairdneri. Copeia No. 4, pp. 865-868.

16141. McNulty, J. Kneeland, William N. Lindall, Jr., and James E. Sykes (NMFS Gulf Coastal Fish. Center, Biol. Lab., St. Petersburg Beach, Florida). 1972. COOPERATIVE GULF OF MEXICO ESTUARINE INVENTORY AND STUDY, FLORIDA: PHASE I, AREA DESCRIPTION. NOAA Technical Report NMFS CIRC 368, 126 p.

Newly-developed tables and maps depict the dimensions, submerged vegetation, tidal marshes, mangrove swamps, commercial oyster beds, leased oyster-rearing areas, sources of pollution, drained tidal marshes, and filled areas of Florida's west coast estuaries. Published and unpublished information on temperature, salinity, geology, artificial fishing reefs, stream discharge, human population, commercial fishing, and economic development is presented in new form. If the total area of estuaries (3,003,312 acres = 1,215,440 ha) is considered to be the area of open water (2,081,525 acres = 842,393 ha) plus the area of mangrove swamps (393,160 acres = 159,112 ha) and tidal marshes (528,528 acres = 213,895 ha), then roughly one-half of the total area of estuaries is unvegetated; the remaining half is about equally divided among mangroves, tidal marshes, and submerged vegetation. Human population in coastal counties increased from 614,616 persons in 1930 to 3,320,226 persons in 1970, resulting in adverse effects from pollution to 43 percent of estuarine areas, filling of 23,521 acres (9,519 ha) mainly for residential and industrial development, and draining of 26,676 acres (10,796 ha) of tidal marshes for mosquito control. Increasing population correlates directly with the number of sources of pollution, filled area, and the area closed to shellfishing by public health authorities; thus, failure to control the adverse effects of population growth will clearly result in continued rapid degradation of estuarine habitat on Florida's west coast. (Authors)

16142. Wedemeyer, Gary (Bur. of Sport Fish. & Wildl., Western Fish Dis. Lab., Sand Point N.S.A., Seattle, Washington 98115). 1972. SOME PHYSIOLOGICAL CONSEQUENCES OF HANDLING STRESS IN THE JUVENILE COHO SALMON (Oncorhynchus kisutch) AND STEELHEAD TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 29(12): 1780-1783.

The stress of handling juvenile coho salmon (Oncorhynchus kisutch) and steelhead trout (Salmo gairdneri) in soft water and in water with added salts was evaluated using blood and tissue chemistry fluctuations as indices of metabolic and endocrine function. Changes in plasma glucose, chloride, calcium, and cholesterol levels indicated that significant osmoregulatory and metabolic dysfunctions can occur and persist for about 24 hr after handling in soft water. Pituitary activation, as judged by lack of interrenal ascorbate depletion, did not occur. Increasing the ambient NaCl and Ca^{++} levels to about 100 milliosmols and 75-120 ppm, respectively, partially or completely alleviated the hyperglycemia and hypochloremia indicating that the stress of handling had been reduced. (Auth.)

16143. Nicol, J. A. C., H. J. Arnott, and A. C. G. Best (Univ. of Texas Mar. Sci. Inst. at Port Aransas, Texas). 1973. TAPETA LUCIDA IN BONY FISHES (ACTINOPTERYGII): A SURVEY. Canad. J. Zool., 51(1): 69-81.

Bony fishes belonging to 75 families were examined for ocular tapeta lucida. The results are collated with published records, and tapeta are shown to occur in 28 families of teleostomes (Holostei and Teleostei) listed in Table 2. Except in the bigeyes Priacanthidae, they are diffuse reflectors located in the pigment epithelium. Based on chemical composition, several types can be distinguished, lipid, guanine (purine), and some others, colored yellow or light tan, of unknown composition. In several tapeta minutely examined, the reflecting material occurs as platelets (guanine type) or as minute tapetal spheres (lipid and others). The tapetum of the bigeye lies in the chorioid, it is a specular reflector containing guanine; as such it is the solitary known exemplar among teleosts. (Authors)

16144. Fontaine, C. T., S. E. P. Gislason, W. L. Trent (NMFS, Gulf Coastal Fish. Center, Galveston Lab., Galveston, Texas 77550). 1972. A SYSTEM FOR COLLECTING LARGE NUMBERS OF LIVE POSTLARVAL PENAEID SHRIMP. NOAA Fishery Bulletin, 70(4): 1298-1302.

16145. Lucký, Z. 1970. PATHOLOGICAL CHANGES WITH OODINIOSIS OF AQUARIUM FISH. Acta Vet. Brno, 39 (Suppl. 1): 57-66; Aquatic Sci. & Fish Abs. Aq 7162F; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 14.

After diagnosing the diseases of tropical aquarium fishes for many years knowledge and material has been obtained enabling judgment of the pathogenicity of Oodinium pillularis. The parasites were found in the following fishes: Rasbora heteromorpha, Colisa lalia, Tanichthys albonubes, Lebistes reticulatus, and Xiphophorus helleri. Colonies of the parasites were found to localize most frequently in the nasal cavities, in the surroundings of the orbits, and in other body hollows. They were found also in the gill cavity and on the gills. The size of the parasites was as much as 0.055 mm. In the present work the normal skin of Coliza lalia fry and skin infested by parasites have been described. Through their rhizoids the parasites cause extensive dystrophic changes of the epidermis, very often together with a demarcated necrosis. As a consequence of traumatic and toxical lesions, hyperplasia of the epidermal cells occurs and a partial demarcation of the parasites. Pathological changes provide good conditions for fungi, bacteria, etc. to attach for secondary infection. -- Aquatic Sci. & Fish. Abs.

16146. Schulz, D. (Inst. Vet.-Path., Freie Univ. Berlin, West Germany). 1971. LIGHT-MICROSCOPIC, BIOCHEMICAL AND ELECTRON-MICROSCOPIC CHANGES IN THE EXOCRINE PANCREAS OF CARP CAUSED BY DOWPON. Zeitschrift für Angewandte Zoologie, No. 58, pp. 63-97; Weed Abstracts, 21(3): p. 253, Abstr. No. 1557, 1972.

Carp kept in aquaria and exposed to dalapon for 4 weeks behaved normally at the lowest concentration tested (2.5 ppm) but showed loss of appetite and dulled response to external stimuli at the higher concentrations, (25 and 250 ppm). Post-mortem findings in the exocrine pancreas included inflammation and degeneration and (in the case of the higher concentrations) decreased RNA (based on wet wt.). The pathological and histological changes are described in detail.

16147. Hendricks, Jerry D. (NMFS, Middle Atlantic Coastal Fish. Center, Pathobiology Investigations, Oxford, Maryland 21654). 1972. TWO NEW HOST SPECIES FOR THE PARASITIC FUNGUS Ichthyophonus hoferi IN THE NORTHWEST ATLANTIC. J. Fish. Res. Bd. Canada, 29(12): 1776-1777.

Microscopic examination of kidney tissues from eight Gulf of Maine fish species revealed cysts of the fungus Ichthyophonus hoferi, Plehn and Mulsow, in individuals from three species. Two of these species, the longhorn sculpin (Myoxocephalus octodecemspinosus) and the Atlantic cod (Gadus morhua), are new hosts for this parasite in Gulf of Maine waters. The other species, the yellowtail flounder (Limanda ferruginea), was previously reported as an Ichthyophonus host. (Auth.)

16148. Morgan, Raymond P., II, Raymond F. Fleming, V. James Rasin, Jr., and Donald R. Heinle (Chesapeake Biol. Lab., Nat. Res. Inst., Univ. of Maryland, Solomons, Maryland 20688). 1973. SUBLETHAL EFFECTS OF BALTIMORE HARBOR WATER ON THE WHITE PERCH, Morone americana, AND THE HOGCHOKER, Trinectes maculatus. Chesapeake Science, 14(1): 17-27.

The purpose of this work was to determine if sublethal effects could be detected in two estuarine teleosts, the white perch (Morone americana) and hogchoker (Trinectes maculatus), exposed to water from Baltimore Harbor. Static bioassays were run using Patuxent River water (control), half-strength Baltimore Harbor water, and full-strength Baltimore Harbor water. Metal and pesticide levels were monitored in each species. Physiological effects of Baltimore Harbor water included changes in thrombocyte, neutrophil, and basophil levels in white perch. Biochemical effects included increased LDH activity in the serum of white perch and hogchokers when exposed to Baltimore Harbor water, decreased acetylcholinesterase activity in white perch and hogchoker brains, and decreased catalase levels of the liver of both white perch and hogchokers. Sublethal effects were noted at the longer (28 and 30 day) exposures to the Baltimore Harbor water. (Authors)

16149. Kramer, David, Mary J. Kalin, Elizabeth G. Stevens, James R. Thrailkill, and James R. Zweifel (NMFS, Southwest Fish. Center, La Jolla, California). 1972. COLLECTING AND PROCESSING DATA ON FISH EGGS AND LARVAE IN THE CALIFORNIA CURRENT REGION. NOAA Technical Report NMFS CIRC-370, 38 p., illus.

Descriptions are given for the methods used by the California Cooperative Oceanic Fisheries Investigations to collect and process plankton. These include details of the design of the station pattern in the survey area, the gear and methods used for plankton hauls, measuring plankton, and sorting plankton for fish eggs and larvae; some procedures for identifying fish eggs and larvae; details of "hand" processing data for standardization of numbers of organisms collected in all plankton hauls; calibration of flowmeters; and some new procedures for automatic data processing. (Authors)

16150. Lucký, Z. 1970. PATHOLOGICAL CHANGES WITH POX (Epithelioma papulosum) IN THE SHEAT FISH (Silurus glanis). Acta Vet. Brno, 39 (Suppl. 1): 81-86; Aquatic Sci. & Fish. Abs. Aq7169F; Fish Health News prepared by Eastern Fish Disease Lab., 2(1): p. 14.

When examining Silurus glanis reared in the pond together with carp, pox (Epithelioma papulosum) was diagnosed. The sheat fishes were examined in Nov. when they had been living in the storage pond for several weeks. The macroscopic and microscopic changes of the skin are described in detail. Hyperplasia of the skin was found on the head, body, back, and fins of 4 sheat fishes out of the total number of 10 fishes examined. The regions of changed skin protruded above the surface only moderately. While in the healthy epidermis ~16, 000 mucous cells were found per 1 sq mm of skin, their number decreased in the damaged skin to 300. A large amount of melanin could be observed in the changed epidermis. The skin was thickened by 50%. Silurus glanis is a new fish sp. very sensitive to this new disease which up to the present day has been described in 11 spp of fresh-water fish. -- Aquatic Sci. & Fish. Abs.

16151. Kott, Edward (Waterloo Lutheran Univ., Waterloo, Ontario, Canada). 1973. EPIDERMAL PIGMENTATION IN THE SEA LAMPREY Petromyzon marinus L. Canad. J. Zool., 51(1): 101-104.

During the spawning migration, the overall color of the sea lamprey (Petromyzon marinus L.) becomes progressively more orange. This color development is not due to the chromatophores of the dermis, since the pigment involved is present in either the epidermis and (or) the outer mucus layer. The color, instead, is resultant upon an increase in the concentration of bilirubin, a bile pigment produced as a breakdown product of hemoglobin. Several postulated mechanisms for bile pigment elimination are discussed. (Auth.)

16152. Johannes, H. (Ciba-Geigy AG, Frankfurt, West Germany). 1971. SIMAZINE AND OTHER TRIAZINES IN FISH WATERS. Proc. of the European Weed Research Council 3rd Internat'l Symp. on Aquatic Weeds, Oxford; Weed Abstracts, 21(3): p. 253, Abstr. 1563.

A report covering general toxicity, toxicity to fish and degradation in water, mud and fish of simazine and other triazines used in fisheries. The triazines do not accumulate significantly in the edible parts of fish and residues disappear on transferring fish to untreated waters. The use of triazine in fisheries at low concentrations is discussed.

16153. Takashima, Fumio, and T. Hibiya. 1972. HEPATIC TUMORS IN YAMAME, Oncorhynchus masou ishikawae: A PRELIMINARY REPORT. Bull. Jap. Soc. Sci. Fish., 38: 955-964; Fish Health News prepared by Eastern Fish Disease Lab., 2(1): p. 17.

The single or multiple nodules were encapsulated and consisted of thickened muralia of basophilic, hyperchromatic cells. The surrounding normal parenchyma showed degenerative changes due to pressure atrophy. -- Marsha Landolt

16154. Courtenay, Walter R., Jr., and C. Richard Robins (Dept. of Biol. Sci., Fla. Atlantic Univ., Boca Raton, Florida 33432). 1973. EXOTIC AQUATIC ORGANISMS IN FLORIDA WITH EMPHASIS ON FISHES: A REVIEW AND RECOMMENDATIONS. Trans. Amer. Fish. Soc., 102(1): 1-12.

Many exotic organisms, particularly fishes and plants, have become a part of Florida's aquatic ecosystems. The majority of these organisms was introduced accidentally as a result of activities of professional aquarists, particularly through carelessness by tropical aquarium fish farm operations. One exotic fish species was established from the release of stocks imported for experimental purposes. Amateur aquarists and tourist attractions also have the potential for introducing exotic aquatic organisms. Future introductions can be reduced through better safeguards in respect to prevention of escape and more public education. Purposeful introductions for sport or food, aquarium resources, or for biological control of pests are more extensive than accidental introductions. Some have the potential for long-term ecological devastation. They are often undertaken without adequate information on the possible consequences. Fish diseases and parasites and their impact on public health have not heretofore been a consideration in the fish import trade. Investigations are urgently needed to determine what may be entering North America with imported fishes and their transport water. Proposals for introduction of a species must be closely studied. Rationale for a planned introduction, demonstration of inadequacy of native species, a search for alternate species, preliminary assessment of environmental impact of the planned introduction, and publicity and review are required initially. Recommendations based on experimental research and review are necessary before any introduction is made. (Authors)

16155. Lucký, Z. 1970. PATHOLOGICAL CHANGES WITH CARP MUCOPHILOSIS. Acta Vet. Brno, 39 (Suppl. 1): 75-80; Aquatic Sci. & Fish. Abs. Aq7163F; Fish Health News prepared by Eastern Fish Dis. Lab., 2(1): p. 14.

The carp disease caused by a parasitic alga, mucophilosis, is quite frequent in carp breeding. This work deals with the pathology of this disease of the gills and with the morphology of its originator. The alga, Mucophilus cyprini, reached as much as 0.030-0.040 mm in size and not 0.060-0.080 mm as has been generally given in compendiums on fish diseases. The alga parasitises the more-layered gill epithelium. If a more massive infestation takes place an acute hyperplasia of the gill epithelium occurs and the infested fish find it very difficult to breathe. -- Aquatic Sci. & Fish. Abs.

16156. Hocutt, Charles H. (Ichthyological Associates, Drumore, Pennsylvania 17537). 1973. SWIMMING PERFORMANCE OF THREE WARMWATER FISHES EXPOSED TO A RAPID TEMPERATURE CHANGE. Chesapeake Science, 14(1): 11-16.

The influence of rapid temperature change on the swimming performance of three warmwater fishes was considered. Juvenile largemouth bass (Micropterus salmoides), spotfin shiners (Notropis spilopterus), and channel catfish (Ictalurus punctatus) collected in 27-31 C ambient lake water were immediately exposed to temperatures ranging from 15 to 35 C at 5 C intervals for 14-20 hours before testing. Exposure to rapid changes in temperature resulted in decreased swimming performance of each species for temperatures other than ambient. (Auth.)

16157. Dimitrov, M., and Lyudskanova, Zh. 1970. THE EFFECT OF GRASS CARP ON THE PRODUCTIVITY OF CARP PONDS. Izvestiya na Stantsiyata po Sladkovodno Ribarstvo, Plovdiv, 7, pp. 45-64; Weed Abstracts, 21(4): Abstr. 1928.

In trials in 1966-67, second-year grass carp (Ctenopharyngodon idella) stocked at 200-600 fish/ha were reared with 2500 second-year common carp (Cyprinus carpio); 82% of the diet of the grass carp consisted of fibrous vegetation such as Typha latifolia, T. angustifolia and Sparganium ramosum and 13% of soft vegetation (mainly Potamogeton natans). Feeding was most intense in May-June when the water temperature was 20°C. Third-year grass carp stocked at 200/ha fed mainly on Typha spp. and Sparganium sp. and then on roots and overhanging bank vegetation. Grass carp yielded 120-800 kg fish/ha and, by fertilizing the pond, increased the production of common carp by 400-500 kg/ha.

16158. Engett, Mary Ellen, and Lee C. Thorson (Scientific Publications Staff, NMFS, U. S. Dept. of Commerce, Seattle, Washington). 1972. FISHERY PUBLICATIONS, CALENDAR YEAR 1970: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-377, 34 p.

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration (until October, 1970 the Bureau of Commercial Fisheries of the U.S. Fish and Wildlife Service) in calendar year 1970 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: Circular, Data Report, Fishery Industrial Research, Fishery Leaflet, and Special Scientific Report—Fisheries. (Authors)

16159. Perrier, C., H. Perrier, and J. Gras (Pharm. de Biochimie, U.E.R. des Sci. Pharm., Lyon Cedex 2, France). 1973. STUDY OF THE HYPERLIPEMIANT EFFECT OF ADRENALIN IN THE CULTURED RAINBOW TROUT (Salmo gairdnerii Richardson) [Etude de l'effet hyperlipemiant de l'adrenaline chez la truite arc-en-ciel d'elevage (Salmo gairdnerii Richardson)]. Experientia, 29(1): p. 24. In French with English summary.

Plasmatic levels of total proteins, total lipids, phospholipids, triglycerides, free cholesterol and cholesterol esters, were measured in rainbow trout (Salmo gairdnerii Rich) after adrenaline administration and confronted with control values. A large increase of total lipids concerning all the fractions studied, and specially triglycerides, was noted. The comparatively small increase of total proteins indicates a selective modification of lipoproteins release. (Authors)

16160. Humphries, Earl T., and Kenneth B. Cumming (Bur. Sport Fish. & Wildl., Va. Coop. Fish. Unit, Va. Polytechnic Inst., Blacksburg, Virginia 24061). 1973. AN EVALUATION OF STRIPED BASS FINGERLING CULTURE. Trans. Amer. Fish. Soc., 102(1): 13-20.

This paper presents a synopsis of investigations concerned with culture of striped bass (Morone saxatilis, Walbaum) fingerlings. An historical review of significant events includes the development of hatcheries and rearing techniques. Changes in food habits and feeding behavior occur with early development of the fish. Early instars of copepods and cladocerans are preferred natural foods until the fish are about 10 mm in total length. The diet of fish in the 10-30 mm size group consists mainly of adult copepods supplemented with some cladocerans and insect larvae. Fish in the 30-80 mm size group utilize fewer copepods while cladocerans and insect larvae make up the major portion of the diet. Insect larvae are the most important foods of fish in the 80-100 mm size group. A comparison of first year growth rates of pond-reared striped bass with those samples from natural waters on the mid-Atlantic Coast indicates that both groups of fish grow at approximately the same rate for the first 30 days, after which the pond-reared fish grow much faster. Striped bass reared in ponds are approximately 170 mm in length at the end of the first year while those in natural waters are about 110 mm long. Factors affecting growth and survival of young striped bass include predation, handling, stress, and various water quality factors. The future outlook for fingerling culture includes the development of hatcheries, nursery ponds, and intensive culture techniques. (Authors)

16161. Grimaldi, E. (Istituto Italiano di Idrobiologia, 28048 Pallanza-Verbania, (Novara), Italy). 1972. FROM AMERICAN CITIZEN TO CITIZEN OF THE WORLD: ORIGIN AND PRESENT DISTRIBUTION OF THE RAINBOW TROUT. (Da cittadina americana a cittadina del mondo: origine e attuale distribuzione della trota iridea). Riv. It. Piscic. Ittiop., 7(3): 63-67. In Italian with Eng. summary.

After delimiting the native range of the rainbow trout, the author outlines to the fishfarmers the history of the introduction of this fish outside North America. He stresses that the presence of many forms of rainbow trout, in particular of migratory "Steelhead" forms and of non-migratory "Shasta" forms, may account for the contradictory results achieved with the introduction of this fish. As to the failure of natural reproduction in waters apparently suitable for it, its reasons are very far from being fully understood. (Auth. summ.)

16162. Myrberg, Arthur A., Jr., Samuel J. Ha, Stanley Walewski, and John C. Banbury (Univ. of Miami, Rosenstiel School of Marine and Atmospheric Sci., Miami, Florida). 1972. EFFECTIVENESS OF ACOUSTIC SIGNALS IN ATTRACTING EPIPELAGIC SHARKS TO AN UNDERWATER SOUND SOURCE. Bull. of Marine Science, 22(4): 926-949.

Three experimental studies were carried out in the field to determine the effectiveness of various acoustic signals in attracting free-ranging silky sharks, Carcharhinus falciformis, into the immediate vicinity of an underwater sound source. These studies were carried out over deep water in the Straits of Florida, miles from the mainland, as well as at a moored buoy in the Tongue of the Ocean, Bahamas. All of the octave bands of noise used in the tests resulted in attraction, with the level of attraction increasing as the frequency spectrum decreased, respectively, from 500-1000 Hz, to 250-500 Hz, to 75-150 Hz, and finally, to 25-50 Hz. Irregularly pulsed signals were also more attractive than regularly pulsed signals, with the latter increasing in attractiveness as the pulse rate increased from 1, to 5, to 10, and finally to 20 pulses/sec. Additionally, it was established that, at least under certain conditions, sharks can be drawn away from one vessel by transmitting irregularly pulsed, low-frequency signals from another vessel, stationed a few hundred meters distant. Various behavioral actions of individual sharks, after approaching a sound source, are described. Also various practical considerations, arising from the findings, are discussed. (Authors)

16163. FAO of the United Nations (Rome, Italy). 1972. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 5(1): 28 p., illus.

Text includes: From research institutions...Induced breeding of gilt-head bream and the European eel - Artificial propagation of grey mullet - Induced breeding of turbot (Psetta maxima) - Induced breeding of Clarias batrachus - Induced breeding of grass carp - Continuous culture of algae for shellfish farming - Utilization of sewage effluent for shellfish culture - Alginate binders for crustacean rations - Pen rearing of chinook salmon - "Salmon Into Sea" programme - Artificial "reconditioning" of Atlantic salmon kelts - Culture of yellow mojarra - Flatfish culture - Culture of snakehead - Shrimp culture - Oyster culture - Marine fish enclosures - Regulations for the use of MS-222 - New laboratories. Aquaculture development...Australia - Cameroon - France - Laos - Malawi - New Zealand - Nigeria - Norway - Peru - Taiwan - United Kingdom - U.S.S.R. Fish diseases and their control...Viral disease of blue catfish - IPN virus from white sucker - "Red mouth" enzootic of rainbow trout in Italy - Treatment of "Red Mouth" disease - Defence mechanism against vibriosis in rainbow trout - IHN survey in Washington - Treatment of gill disease - An aeromonad epidemic in brown trout - Ichthyophthiriasis - Parasites of pond-raised Clarias in Thailand - Parasites of commercial crabs - Control of bacterial fish diseases - Effect of diet on occurrence of kidney disease in salmonids. Fish and shellfish introductions...Recent introductions - Introduction of salmon strains in Norway - Israeli carp in Cameroon - Grass carp distribution in Arkansas (U.S.A.) - Control of catfish and grass carp introduction in Missouri (U.S.A.). (From contents)

16164. Tiemeier, O. W., M. A. Lambert, and C. W. Deyoe. 1970. LENGTH-WEIGHT RELATIONSHIP OF SUPPLEMENTARY FED AND NON-FED CHANNEL CATFISH. Trans. Kansas Acad. of Science, 73(2): 252-256.

Total lengths and weights of 7,124 channel catfish (Ictalurus punctatus) were recorded and grouped into length-weight classes. Data included information on 4,691 fish supplementally fed and 2,433 non-fed fish. All data were from fish stocked in Kansas farm ponds. The linear relationships, log-regression equations and condition factors for the two groups were calculated. (Authors)

16165. Dow, Robert L., and John W. Hurst, Jr. 1972. RENEWABLE RESOURCE PROBLEMS OF HEAVY METAL MINING IN COASTAL MAINE. Research Bulletin No. 35 reprinted from National Fisherman - October 1972, 9 p., illus.

16166. Moskalenko, B. K. (Limnol. Inst., Sib. Div., USSR Acad. of Science, Listvenichnoye, USSR). 1971. THE BIOLOGICAL PRODUCTIVITY OF LAKE BAYKAL. Hydrobiological Journal, 7(5): 1-8.

The most important results of many years study of the biological productivity of the pelagic regions of Lake Baykal are presented. It is shown that Lake Baykal is not an ultra-oligotrophic, but a mesotrophic body of water. But because of the unusual nature of the ecosystem in the pelagic region of the lake, the economic productivity of this region is not large. It is limited to the omul and the Baykal hair seal. Methods of increasing the yield of useful products are outlined. (Auth.)

16167. Snelson, Franklin F., Jr. 1968. SYSTEMATICS OF THE CYPRINID FISH Notropis amoenus, WITH COMMENTS ON THE SUBGENUS Notropis. Reprint from Copeia, No. 4, 776-802.

Notropis amoenus (Abbott) is redescribed and a detailed synonymy presented. Comments are made regarding its nomenclature, type-specimens, and habitat. Sixteen meristic and 10 morphometric characters show no regular pattern of geographic variation and no subspecies are recognized. The most variable meristic character is predorsal scale size; specimens with small, irregularly-arranged predorsal scales become progressively more frequent in northern populations. Mandible and snout lengths are generally shorter in northern populations, complicating the separation of N. amoenus from the closely related Notropis atherinoides Rafinesque. Sexual dimorphism in N. amoenus is weakly developed and confined chiefly to tuberculation differences, which are described. Breeding individuals show no chromatic coloration. N. amoenus is compared with similar and related species. It is specifically distinct from and distantly related to Notropis rubellus (Agassiz), a sympatric and often confused species. Notropis photogenis (Cope) differs from N. amoenus in possessing nine pelvic fin rays, an extremely rare feature in the genus. N. atherinoides is the closest relative of N. amoenus; distinguishing characters are scale counts, head proportions, and trophic modifications. The two species are largely allopatric, but their ranges overlap or come into proximity in New York. The ranges of N. amoenus and central and southeastern New York N. atherinoides are plotted, and their postglacial zoogeography discussed. The dispersal of both species has been influenced by man. N. amoenus is assigned to the subgenus Notropis Rafinesque, and problems within this group are discussed. The subgenus is divisible into two sections on the basis of breeding coloration and pectoral fin tuberculation. The N. rubellus group exhibits chromatic breeding colors. The first ray of the pectoral fin is nontuberculate and following rays bear a single file of large tubercles, a single tubercle occupying each ray segment. This group has no close relative among species currently assigned to the subgenus, and may be related to some species currently classified in the subgenus Hydrophlox Jordan and Brayton. The N. atherinoides group (which includes N. amoenus) and species commonly classified near it are characterized by the absence of chromatic breeding colors. The first ray of the pectoral fin is tuberculate and the following rays bear small tubercles arranged bi- or multiserially, with 8-20 tubercles per ray segment. Further study is required to establish the naturalness of this group, to which a relatively diverse assemblage of species has been assigned. Character trends exhibited by some species are toward a larger eye, more anterior insertion of the dorsal fin, more robust body form, fewer anal fin rays, and larger scales. (Auth.)

16168. Cairns, John, Jr., Guy R. Lanza, and Bruce C. Parker (Limnol. Dept., Acad. of Nat. Sciences, and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1972. POLLUTION RELATED STRUCTURAL AND FUNCTIONAL CHANGES IN AQUATIC COMMUNITIES WITH EMPHASIS ON FRESHWATER ALGAE AND PROTOZOA. Proc. Acad. of Natural Sciences of Philadelphia, 124(5): 79-127.

This paper includes a discussion of certain select aspects of structural and functional changes in algal and protozoan communities and how they relate to the assessment and solution of pollution related problems. New methods and concepts developed by the authors are related to older methods and concepts. The various types of pollutional stress are discussed together with their effects on algal and protozoan communities. (Authors)

16169. Peterson, James O., J. Peter Wall, Thomas L. Wirth, and Stephen M. Born. 1973. EUTROPHICATION CONTROL: NUTRIENT INACTIVATION BY CHEMICAL PRECIPITATION AT HORSESHOE LAKE, WISCONSIN. Technical Bulletin No. 62, Dept. of Natural Resources, Madison, Wisconsin, 20 p.

Numerous methods have been suggested for retarding or reversing lake eutrophication, a process that occurs under natural conditions but is sharply accelerated by activities of man. Nutrient inactivation by chemical means is one method that has been proposed. The method reported here seeks to limit nuisance algal production resulting from lake fertilization by the use of alum (aluminum sulfate) to remove phosphorus, one critical element for plant nutrition. The method represents an extrapolation of advanced waste treatment technology to a natural lake setting where phosphorus is removed by precipitation, sorption, and physical entrapment and sedimentation in a flocculant aluminum hydroxide precipitate. Prior to the effort by the Inland Lake Demonstration Project, this method had never been tried before in the United States on an entire lake. Horseshoe Lake, a 22-acre (8.9 ha), 55-foot (16.7 m) deep, eutrophic lake in east central Wisconsin was treated in May, 1970, when approximately 11 short tons of slurried alum were distributed in its upper 2 feet of water. Alum concentrations in the treated volume were about 200 mg/l (18 mg A l/l), which, based on laboratory testing, resulted in maximum phosphorus removal with minimal ecologic risk. The results of the treatment include: (1) a decrease in total phosphorus in the lake; (2) no large increase in total phosphorus in the anoxic hypolimnion during summer stratifications following treatment as noted in other eutrophic lakes and prior to treatment in Horseshoe Lake; (3) some increase in the transparency of the water during the summer following treatment; (4) a short-term decrease in color; (5) an absence of the nuisance planktonic algal blooms that had been common in previous years; (6) an improvement in dissolved oxygen conditions, especially during the following two winters; and (7) no observations of adverse ecological consequences. The generally positive results obtained in this demonstration project will hopefully stimulate longer-term and more thorough research evaluations of this potentially fruitful renovation technique for eutrophic lakes. (Authors)

16170. Brenner, Steven R., and Otto W. Tiemeier (Div. of Biol., Kansas State Univ., Manhattan, Kansas 66502). 1971. LIPOFUSCIN ACCUMULATION IN THE CHANNEL CATFISH, Ictalurus punctatus. Trans. Kansas Acad. of Science, 73(3): 390-393.

Even though channel catfish grew throughout their entire lives, certain cells in their brains accumulated lipofuscin. Fish younger than two years old did not contain lipofuscin, but fish from three to eight years old contained increasing amounts of lipofuscin with increasing age. (Authors' discussion)

16171. Johnston, I. A., and G. Goldspink (Muscle Res. Lab., Dept. of Zool., Univ. of Hull, Hull, Yorkshire, England). 1973. A STUDY OF GLYCOGEN AND LACTATE IN THE MYOTOMAL MUSCLES AND LIVER OF THE COALFISH (Gadus virens L.) DURING SUSTAINED SWIMMING. J. Mar. Biol. Assn. U.K., 53(1): 17-26.

The locomotor roles of the myotomal muscles of fish are dependent on swimming speed. The mean maximum sustained swimming speed for coalfish (Gadus virens L.) during a 6-h period in an experimental exercise chamber was determined using a fixed-velocity technique and found to be 4 bodylengths/s. Biochemical measurements were made on the concentration of glycogen and lactate in the red muscle and white muscle at a series of known swimming speeds. Evidence is provided that red muscle alone is used at speeds below 2 bodylengths/s. The fall in concentration of red muscle glycogen was directly proportional to increased swimming speed. At speeds in excess of 2 bodylengths/s a statistically significant increase in lactate concentration occurred in the white muscle fibres. A reduction in glycogen content of the white muscle was also noted at speeds at and above the estimated mean sustained swimming speed. These results are discussed in the light of the current ideas pertaining to the division of labour between myotomal muscles in fish. (Authors)

16172. Snelson, Franklin F., Jr. (Fla. Technological Univ., P. O. Box 25000, Orlando, Florida 32816). 1972. SYSTEMATICS OF THE SUBGENUS Lythrurus, GENUS Notropis (PISCES: CYPRINIDAE). Bull. of the Florida State Museum, 17(1): 92 p.

The subgenus Lythrurus Jordan is diagnosed and its nomenclature discussed. Closely related to the atherinoides series of the subgenus Notropis Rafinesque, Lythrurus is composed of four species groups distinguished on the basis of tuberculation, vertebral number, and pigmentation. These groups are as follows: (1) the fumeus complex, includes only Notropis fumeus Evermann; (2) the ardens complex, includes N. ardens (Cope) and N. lirus (Jordan); (3) the umbratilis complex, includes N. umbratilis (Girard) and subspecies; and (4) the roseipinnis complex, which is revised herein. Members of the roseipinnis complex are distributed primarily in streams of the eastern Gulf Coast. All forms are closely related and distinguished chiefly on measurements and pigmentation, especially that of the fins. N. b. bellus (Hay) shows little geographic variation and is distributed throughout most of the Mobile Bay basin. It is absent above the Fall Line in the Coosa River system. Above the Fall Line in the Black Warrior River system it is replaced by a strongly differentiated new subspecies, N. b. alegnotus. These two forms appear to have interbred and formed intergrade populations around Tuscaloosa, Alabama. N. roseipinnis (Hay) is distributed in Gulf Coastal streams from Mobile Bay west through Lake Pontchartrain and in the Bayou Pierre, Big Black, and Yazoo drainages of the Mississippi Valley. This species exhibits striking geographic variation, much of an east-west clinal nature. Though they have not been collected together, N. b. bellus and N. roseipinnis live in close proximity in the lower Mobile Bay drainage. Here they are strongly differentiated, but more westerly populations of N. roseipinnis approach N. b. bellus in many features. N. atrapiculus, a new form previously confused with N. b. bellus and N. roseipinnis, is distributed in streams along the eastern Gulf Coast from the Escambia to the Apalachicola drainage. It is allopatric from its two close relatives and is intermediate or interjacent between them in most differentiating characters. Because of its intermediacy and the resulting weak differentiation, its proper taxonomic status is debatable. As nothing suggests whether it is more closely related to N. b. bellus or to N. roseipinnis, atrapiculus is accorded specific rank. (Auth.)

16173. Huckabee, J. W., B. G. Blaylock, and N. A. Griffith (Oak Ridge National Lab., Tennessee). 1972. MERCURY: BEHAVIOR OF METHYL AND NITRATE FORMS IN NATURAL STREAM ECOSYSTEMS. Oak Ridge Nat'l. Lab., - Environ. Science Div., Prepublication copy, 9 p.; Selected Water Resources Abstracts, 6(2): p. 60, 1973.

Studies on 100 m. sections of two small streams with radioactive mercury compounds and fluorescein dye showed that the rate of transport of methylmercuric chloride and mercuric nitrate in oligotrophic streams is similar. Water, fish, snails, watercress, periphyton and sediments were collected. Biotic uptake of the two forms of mercury differs following an acute input. The decreasing order for uptake of methylmercury was as follows: fish > snails periphyton > macrophytes > sediments. The uptake of mercuric nitrate was snails > periphyton, macrophytes, sediments > fish.

16174. Bilton, H. T., and G. L. Robins (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. THE EFFECTS OF STARVATION AND SUBSEQUENT FEEDING ON SURVIVAL AND GROWTH OF FULTON CHANNEL SOCKEYE SALMON FRY (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 30(1): 1-5.

In the laboratory 8 groups of Fulton River channel fry were starved for periods ranging from 1 to 7 weeks, then offered food ad libitum for 8 weeks. Fry withstood up to 4-weeks starvation with less than 10% mortality; beyond this point mortality increased sharply to 90% at 7-weeks starvation. At 5-weeks starvation both fry length and weight decreased significantly. Mortality continued when fish were offered food ad libitum after being starved. Among fish starved for 1 and 2 weeks, mortalities continued to be low, 0 and 6.6%, respectively; but among fish starved from 3 to 5 weeks, mortalities rose considerably, ranging from 42 to 99%. (Authors)

16175. Donaldson, L. R., K. Bonham, and W. K. Hershberger (Coll. of Fish., Wash. Univ., Seattle, Washington). 1972. LOW LEVEL CHRONIC IRRADIATION OF SALMON. ANNUAL PROGRESS REPORT. Available from NTIS, Springfield, Va. as RLO-2225-T-2-3, $3.00 in paper copy, $0.95 in microfiche. Report 35 p.; Selected Water Resources Abstracts, 6(5): p. 57, 1973.

The number of adults returning over a 5-year period was unaffected by exposure of the smolts during the brood year 1966 to 2.8 rads/day for a total of 235 rads. However, it is expected that fewer will return of those irradiated in later brood years to 10-50 rads/day. Retardation in gonadal development of premigratory smolts was produced by 10 rads/day. A lack of spermatoonia or oogonia in the histological sections of fingerlings was produced by 20 rads/day. Further study is expected to reveal quantitative relationships between gonadal conditions and irradiation damage to other tissues. Additional facilities were installed for rearing the young fish for an expanded program to evaluate delayed genetic effects.

16176. Siegmund, R., and D. L. Wolff (Sek. Biol. Humboldt Univ., Bereich Verhaltenswiss., Berlin, GDR, Germany). 1973. CIRCADIAN RHYTHM AND GROUP BEHAVIOR IN Leucaspius delineatus (PISCES, CYPRINIDAE). [Circadian-Rhythmik und Gruppenverhalten bei Leucaspius delineatus (Pisces, Cyprinidae)]. Experientia, 29(1): 54-58. In German with English summary.

In constant illumination fish groups and isolated fish exhibit a free running rhythm. The period length of the day active animals decreases with increasing light intensity and vice versa. The results correspond to the circadian rule, the validity of which has proved correct now for fish, too. The synchronization within fish groups is also influenced by socio-ecological factors.

16177. Morgan, Raymond P., II, Ted S. Y. Koo, and George E. Krantz (Univ. of Maryland, Chesapeake Biol. Lab., Solomons, Maryland 20688). 1973. ELECTROPHORETIC DETERMINATION OF POPULATIONS OF THE STRIPED BASS, Morone saxatilis, IN THE UPPER CHESAPEAKE BAY. Trans. Amer. Fish. Soc., 102(1): 21-32.

Striped bass Morone saxatilis from the Upper Chesapeake Bay were studied to determine if discrete populations exist. Spawning fish and juveniles in five rivers, the Patuxent, Potomac, Choptank, Elk, and Nanticoke were sampled. Discontinuous polyacrylamide gel electrophoresis separated the serum proteins for population analysis. Five proteins, which were not related to the age, sex, or time of collection of striped bass, were used to discern populations. The Elk River striped bass are very distinct. Both the Choptank and Nanticoke are also distinct but show some connection with the Patuxent and Potomac striped bass. The Patuxent and the Potomac striped bass could not be distinguished from each other on the basis of the five proteins studied. The geologic evidence supports the theory of population formation for striped bass in the Chesapeake Bay. Management implications of the striped bass populations are also discussed. (Authors)

16178. Andreyev, V. L., and V. I. Dulepov (Far East St. Univ., Vladivostok, USSR). 1971. Salvelinus leucomaenis FROM THE SOUTH KURILE ISLANDS. Hydrobiological Journal, 7(6): 59-66.

Biological characteristics of Iturup Island Salvelinus leucomaenis, namely morphometry, age, size, and weight distribution, linear and weight growth, fecundity, sex ratio, nutrition of juveniles, etc. are given. Empirical formulas derived from a statistical analysis of the material are used to describe the correlations between length, weight, fecundity, etc., natural mortality rate, rate of maturation, and probability of migration to sea. The growth rate is analyzed by means of a correlation function. Emphasis is placed on the role of the trout as a predator and competitor of young of Pacific salmon. (Authors)

16179. Buchanan, Chester C. (NMFS, Sandy Hook Marine Lab., Highlands, New Jersey). 1971. A COMPARISON OF SPORT FISHING STATISTICS FROM MAN-MADE AND NATURAL HABITATS IN THE NEW YORK BIGHT. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971, Jekyll Island, Ga., Coastal Plains Center for Marine Development Services, Seminar Series No. 1, pp. 27-37.

16180. McIntyre, A. D., and D. J. Murison (Marine Lab., Aberdeen, Scotland). 1973. THE MEIOFAUNA OF A FLATFISH NURSERY GROUND. J. Mar. Biol. Assn. U.K., 53(1): 93-118.

The meiofauna was studied over a 10-year period on a flatfish nursery ground between the high-water mark and a depth of 10 m below low-water springs. The sediment was well sorted sand, with median diameter from 210 to 279 μ in the intertidal area and 160 to 208 μ in the subtidal. It was composed of medium rounded quartz, with the calcium carbonate content mainly 0.25 to 2.20% by weight. Porosity was 33-39% and the coefficient of permeability ranged from 1.66 to 2.33 x 10^{-2} cm per sec, indicating good drainage. The sand was usually over 90% water-saturated, and seldom less than 60%. The annual average concentration of particulate organic carbon was 205 μg/g sand in the intertidal, and 684 μg/g at 5 m depth. Corresponding values for chlorophyll α were 0.75 and 4.50 μg/g. The most numerous taxonomic groups were nematodes, copepods, turbellarians, gastrotrichs and tardigrades. Oligochaetes, polychaetes, coelenterates and archiannelids occurred in smaller numbers. Total meiofauna individuals averaged from 0.5 x 10^6 to 6.7 x 10^6 per m^2 and the corresponding biomass from 279 mg to 1092 mg dry weight per m^2. There was a distinct zonation of fauna, the richest populations occurring from around the level of mean low-water neaps on the beach to about 1 m depth below low water. The populations were most sparse in both numbers and species above mean high-water neaps. Below midtide level the bulk of the meiofauna was found in the upper 4 cm of sand, but there was a significant vertical migration apparently depending on the state of the tide, and a general downward movement during the winter. At higher beach levels the vertical distribution was less regular. During a 6-year period of detailed observation, significant overall annual change in the populations was detected only once, when, due to severe storms, there was a drastic decline in numbers, but recovery took place the following year. The optimum sediment for interstitial meiofauna appears to be well-sorted sand of median diameter about 230 μ, but other density-independent factors affecting the populations are discussed. On an exposed beach the typical meiofauna comprises a community of high individual numbers with a stable and permanent set of species of great diversity. This is contrasted with the equivalent macrofauna community, and reasons for the differences in diversity discussed in terms of niche utilization. Meiofauna populations on exposed sandy beaches may be fuelled largely by soluble organic matter via bacteria attached to sand grains. No great interaction was shown with other groups on the beach and no significant transfer of material to higher trophic levels was observed. It is suggested that meiofauna in these circumstances may be largely at the top of a food chain. (Authors)

16181. Gofman-Kadoshnikov, P. B., T. P. Chizhova, and T. A. Yakovleva. 1970. A NEW TYPE OF DIPHYLLOBOTHRIID PLEROCERCOID FROM CHUM SALMON FROM KAMCHATKA. Meditsinskaya Parazitologiya i Parazitarnye Bolezni, Moskva, 39(2): 237-239; Fish Health News prepared at Eastern Fish Disease Lab., Kearneysville, West Virginia, p. 11. - Translated by Dr. L. Margolis, Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia.

16182. Opuszynski, Karol (Inland Fish. Inst., Zablenlec near Warsaw, p-ta Piaseczno, Poland). 1972. USE OF PHYTOPHAGOUS FISH TO CONTROL AQUATIC PLANTS. Aquaculture, Netherlands, 1(1): 61-74; Wiadomosci Ekol., 18(2): 111-125.

Effectiveness of grass carp in control of water weeds depends on a number of factors, the most important being water temperature, species composition of plants, individual weight of fish and stock density. Under thermal conditions of Northern and Middle Europe an effective control of water weeds requires very dense stocks with a high initial weight of fish. Such dense stocks are not always economically justified. However, grass carp used as a supplement to mechanical and chemical methods applied so far, may contribute to the limitation of water overgrowth stimulating at the same time additional resources for fisheries. Under the same climatic conditions grass carp proved to be very effective in controlling water weeds in water bodies heated by effluents from thermal power stations. Stocking of water in tropical climates as well as in Southern Europe, may solve that problem

of overgrowth of water bodies without using the traditional methods. In addition to reduction of aquatic plants phytophagous fish may cause considerable changes in biocenosis. Controlling of water blooms with use of silver carp (Hypophthalmichthys molitrix Val.) has been discussed. Application of this species for controlling the phytoplankton requires further study.

16183. Devaraj, K. V., T. J. Varghese, and G. P. Satyanarayana Rao (Fisheries College, Univ. of Agric. Sciences, Mangalore - 575001, India). 1972. INDUCED BREEDING OF THE FRESHWATER CATFISH Clarias batrachus (Linn.) BY USING PITUITARY GLANDS FROM MARINE CATFISH. Curr. Sci., 41(24): 868-870.

The freshwater catfish, Clarias batrachus (Linn.) was bred successfully by the administration of homoplastic and heteroplastic pituitary extract injections at the Fisheries College, Mangalore, India. In the latter case, pituitary glands taken from the marine catfish, Tachysurus sp. were used, at a high dose of 30 mg/kg. There appears to be no earlier record of breeding a freshwater fish by injecting pituitary extract from a purely marine fish. In all, eighty percent of the fish injected with either homoplastic or heteroplastic extracts responded and spawned. The number of eggs released by individual fish ranged between 1,968 and 7,380. The percentage of fertilized eggs varied from 77 to 98. The eggs hatched out in about 26-32 hours after breeding, in water temperatures ranging from 24°C to 28°C. The hatchlings were fed on zooplankton after the yolk sac was completely absorbed on the fifth day after hatching. The successful use of marine catfish glands to breed C. batrachus indicates that it may be possible to tap the same source of pituitary glands for induced breeding of Indian major carps. (Authors)

16184. Ghittino, P. 1972. EXOTIC FISH DISEASES THREATENING TROUT - AND CARP - FARMING IN ITALY. (Malattie esotiche dei pesci che minacciano troticoltura e carpicoltura italiane). From lecture at Gen. Assembly of the Italian Fishfarms Assoc., Desenzano, Italy, April 9, 1972; Riv. It. Piscic. Ittiop., 7(3): 53-61. (In Italian with English summary).

The most important exotic fish diseases threatening the Italian fishfarming are critically described by the lecturer, who emphasizes that the subject of his lecture has been chosen with the purpose of putting into effect the act of January 23, 1968, n. 34, which stresses the importance of giving to the breeders scientific information on the exotic diseases of animals. As a preliminary remark, it is recalled that trout culture is by far the most important kind of fish culture in Italy, satisfying the domestic demand as well as exporting some product. On the contrary, carp culture, and generally warmwater fish culture, has been up to now quite unimportant in this country. At present, importation from abroad of live fish, among which several tons of table-carp and -tench, as well as of fish ova, is still a necessity at the risk of introducing fish diseases not present before in Italy which, because of their suspected or confirmed viral nature, are highly contagious and incurable. Among trout diseases the viral Infectious Pancreatic Necrosis has just been detected in Italy, as well as in the other European countries. As stressed by the author, the identification of this disease requires a complex scientific methodology; moreover, it may be just "virologically" present in a trout farm without bringing about any "clinical" disease, followed by mortality. A prophylactic campaign against the Infectious Pancreatic Necrosis, which would be the only efficacious method of control, is likely to raise enormous difficulties, especially in a country where they have not been, or have not intended, to eradicate dangerous and widespread fish disease, like the Viral Hemorrhagic Septicaemia, much more easy to identify and to eliminate. Another salmonid disease, the Infectious Hematopoietic Disease, just found in the U.S.A., could be introduced into Italy through infected eyed eggs. However, this possibility claims further accurate controls. Lastly, the Swimbladder Inflammation and the Infectious Gill Necrosis of carp, as well as the Channel Catfish Virus Disease, still absent from Italy, have been quoted by the lecturer. These diffusive diseases could be imported through uncontrolled commercial exchanges.

16185. Taylor, F. H. C., and Margaret Burke (Fish. Res. Bd. Canada, Pacific Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1972. ANNULUS FORMATION IN PACIFIC HERRING SCALES. Fish. Res. Bd. Canada Tech. Report No. 360, 35 p.

16186. Fierstine, Harry L., Kurt F. Kline, and Gregory R. Garman. 1973. FISHES COLLECTED IN MORRO BAY, CALIFORNIA BETWEEN JANUARY, 1968 AND DECEMBER, 1970. Calif. Fish and Game 59(1): 73-88.

Sixty-six species of fish were collected in Morro Bay between January, 1968 and December, 1970. The bay was divided into five ecological zones. Zone I was characterized by sandy beaches with little algae and contained 10 species. Zone II contained 35 species and was characterized by a sandy-silt bottom with some Zostera and kelp beds scattered among commercial piers. Zone III contained 31 species and was characterized by more Zostera beds and fewer commercial developments than Zone II. Zone IV contained 30 species and was characterized by large expanses of shallow Zostera beds dissected by very narrow channels. Zone V was an estuary with a mud bottom and contained 13 species. Thirty-seven percent of the catch belonged to the family Embiotocidae of which the black perch and shiner perch contributed 22% of the catch. Twelve species were captured during six or more months of the year and probably are annual residents. Twenty-six species were collected during a single month and probably are seasonal or occasional visitors. (Authors)

16187. Lewis, Thomas L., and August Epple (Daniel Baugh Inst. of Anatomy, Jefferson Medical College of Thomas Jefferson Univ., Philadelphia, Pennsylvania). 1972. PANCREATECTOMY IN THE EEL: EFFECTS ON SERUM GLUCOSE AND CHOLESTEROL. Science, 178(4067): 1286-1288; NOAA Marine Fisheries Abstracts, 26(3): p. 3, 1973.

Little is understood about the physiological role of the endocrine pancreas in fishes; furthermore, the few data on pancreatectomy or isletectomy in teleosts are in part contradictory. The American eel is the only teleost known to have all islet tissue concentrated in a compact pancreas. The researchers examined the effects of pancreatectomy of the American eel on (1) serum glucose, as an indicator of diabetic alterations; and (2) serum cholesterol, because of its high levels in some teleosts (particularly the eel). Pancreatectomy in the American eel caused a slight tendency toward hypoglycemia. Total and partial pancreatectomies caused a drop of total serum cholesterol. The total serum cholesterol of the eel is comprised of two fractions, one of which is pancrease dependent (this fraction amounts to about 70 to 80%). The complete removal of the islet tissue in the eel, thus, is not followed by diabetes mellitus; furthermore, the endocrine control of the cholesterol-containing serum seems to differ from that in mammals.

16188. Beard, Thomas D. (Bureau of Research, Spooner, Wisconsin). 1973. OVERWINTER DRAWDOWN. IMPACT ON THE AQUATIC VEGETATION IN MURPHY FLOWAGE, WISCONSIN. Dept. of Nat. Resources, Madison, Wisconsin Technical Bulletin No. 61, 14 p., illus.

A lowering of the water level on Murphy Flowage during the winters of 1967-68 and 1968-69 resulted in a significant reduction in the relative abundance and acreage of aquatic vegetation. Before the drawdown approximately 75 acres (42% of the flowage) were covered by plants to the extent that fishing was almost impossible in these areas from June through the summer. After two overwinter drawdowns 60 of the 75 acres was still open to fishing. Five of the six species in greatest dominance before the drawdown were most affected, and these five species showed a reduction of 187.3 acres after two drawdowns. The last section deals with items that should be considered by management personnel in the use of an overwinter drawdown to control aquatic vegetation. (Auth.)

16189. Flerov, B. A. (Inst. of Biol. of Inland Waters, USSR Acad. of Science, Borok, USSR). 1971. ADAPTATION OF HYDROBIONTS TO A TOXIC FACTOR. Hydrobiological Journal, 7(6): 49-53.

Evidence is presented to show that the adaptation of hydrobionts to toxic substances is the result of selection of the most resistant individuals.

16190. Tiemeier, Otto W. 1970. FOOD AND NUTRITION OF CHANNEL CATFISH. Reprint from Proc. of the Missouri Catfish Conf., March 10-11, 1970, Lake Ozark, Missouri, pp. 6-10.

16191. Sobolev, Yu. A. (Byeloruss. Res. Inst. of Fisheries, Minsk, USSR). 1971. THE NATURAL FOOD SUPPLY IN PONDS WHEN PLANT-EATING FISHES ARE RAISED TOGETHER WITH POND CARP. Hydrobiological Journal, 7(5): 44-50.

Two years of investigation in the Byelorussian SSR have demonstrated that raising white amur and silver carp together with pond carp tends to increase the biomass of zooplankton 2 or 3 times as compared with ponds in which the pond carp is raised as a single crop. Therefore, the fish productivity of ponds is increased not only by the additional productivity of amur and silver carp, but also by the additional production of pond carp.

16192. Henderson, F. (Fish Stock Evaluation Branch, Fishery Resources Div., FAO, Rome, Italy). 1972. THE DYNAMICS OF THE MEAN-SIZE STATISTIC IN A CHANGING FISHERY. FAO Fisheries Technical Paper No. 116, 16 p. (Distribution restricted).

Graphs of simultaneous observations of the mean-weight (or other average size criterion) and population abundance (e.g. catch/effort) may be useful in deciding which of several possible factors may be responsible for changes in the average weight of individuals in a population, even if environmental conditions in the fishery are known to be changing. Independent information on rates of growth, and control over the selectivity of the sampling method are also needed if reasonably secure inferences are to be made. If the sample variance of the estimates is reasonably small relative to the observed changes over time, the pattern exhibited by successive observations may be compared with the patterns expected from simulation for various kinds of change in the population parameters. If there is evidence of a sudden and substantial change at a known point in time, the direction and magnitude of the first response is a useful predictor of the equilibrium response. Otherwise such a plot may primarily be useful in distinguishing real changes and trends in mortality from changes in size composition of the population brought about by variations in recruitment. The latter use requires much longer sequences of observations. (Auth. summ.)

16193. Whitt, Gregory S., William F. Childers, John Tranquilli, and Michael Champion (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1973. EXTENSIVE HETEROZYGOSITY AT THREE ENZYME LOCI IN HYBRID SUNFISH POPULATIONS. Biochemical Genetics, 8(1): 55-72.

Hybrid populations of sunfishes were produced in two different ponds, and the frequencies of allelic isozyme phenotypes were determined for three enzyme systems - malate dehydrogenase (NAD), esterases, and tetrazolium oxidase - in order to estimate the extent of heterozygosity at four different genetic loci. Interspecific F_1 hybrid fry (red-ear male x bluegill female) were produced in vitro. These fry were stocked in ponds at the free-swimming stage. When 1 year old, the F_1 hybrids produced a large F_2 hybrid population. Successful hybrid reproduction occurred each year thereafter. In one pond, a 1-year-old F_2 population exhibited all three isozyme phenotypes (red-ear, F_1, bluegill) at most loci in the approximate ratio of the 1:2:1 expected. In a second pond, 5-year-old individuals of the F_2 generation were morphologically like the F_1 and were all heterozygous for the enzyme loci studied. This unusual degree of heterozygosity in the older F_2 population appeared to be the result of differential survival of mature heterozygous individuals and not the result of early embryonic lethality. The increased heterozygosity at these unlinked loci was assumed to reflect the condition at other genetic loci in the F_2 hybrids. Several possible mechanisms are advanced to explain this apparent heterosis. (Authors)

16194. Bond, Carl E. 1973. OCCURRENCE OF THE RETICULATE SCULPIN, Cottus perplexus, IN CALIFORNIA, WITH DISTRIBUTIONAL NOTES ON Cottus gulosus IN OREGON AND WASHINGTON. Calif. Fish and Game, 59(1): 93-94.

The reticulate sculpin is reported from a fork of the Applegate River in northern California. This river is part of the Rogue River drainage. (Auth.)

16195. Dow, Robert L. 1972. PESTICIDES IN FISH AND SHELLFISH. Research Bull. No. 32 reprinted from National Fisherman, 5 p.

16196. Moore, J. W., and F. W. H. Beamish (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1973. FOOD OF LARVAL SEA LAMPREY (Petromyzon marinus) AND AMERICAN BROOK LAMPREY (Lampetra lamottei). J. Fish. Res. Bd. Canada, 30(1): 7-15.

Throughout the year, algae were the most frequently encountered organisms in the gut of larvae of landlocked and anadromous sea lamprey (Petromyzon marinus) and American brook lamprey (Lampetra lamottei). Relative abundance of organisms in the gut of both species was similar and did not change with length of larvae. In general, relative abundance of organisms in the gut was similar to that in samples of sediment and water. Occasionally, filamentous and episammic forms were not ingested because of their larger size. The number of algal cells ingested per unit weight of sea lamprey decreased inversely with size of larvae. In the summer the number of algal cells in the gut was about thrice that found in the winter for larvae of comparable size. Survival among diatoms evacuated from the digestive tract varied from 45% in July (17.8 C) to 90% in January (0 C). Representatives of the Achnanthes had the lowest survival rate (10-20%), while those of Amphora and Cyclotella had the highest (65-100%). Complete evacuation required approximately 54 and 70 hr at 16.0 and 2.5 C, respectively. Evacuation rate did not differ among the organisms consumed. The numbers of algae consumed by larval sea lamprey in a stream relative to their estimated abundance was considered negligible. (Authors)

16197. Roberts, R. J. (Unit of Aquatic Pathobiology, Univ. of Stirling, Stirling, Scotland). 1972. ORAL CARCINOMATA IN A SALMON (Salmo salar L.). The Veterinary Record, August 19, p. 199; Fish Health News prepared at Eastern Fish Disease Lab., 2(1): p. 15.

A note describing and illustrating an invasive carcinoma, presumptively of squamous cell origin, on the upper and lower jaws of an adult male Atlantic salmon taken by angling in Loch Lomond, Scotland. Although sought, metastases were not found elsewhere in or on the fish. -- Ken Wolf

16198. Wise, John P., and Charles W. Davis (NMFS, Southeast Fish. Center, Miami Lab., Miami, Florida 33149). 1973. SEASONAL DISTRIBUTION OF TUNAS AND BILLFISHES IN THE ATLANTIC. NOAA Technical Report NMFS SSRF-662, 25 p.

Charts of the Atlantic Ocean for each quarter of the year - January-March, etc. - show the distribution of 10 species and groups of species fished by the Japanese Atlantic longline fishery in the years 1956-68. These charts are based on detailed catch and fishing effort data published by the Japanese Government. Quarterly average catch per unit of effort was calculated for each 5° X 5° square, and contour lines were drawn through equal levels of catch per unit of effort. The text explains the calculation and contouring processes in detail, and has a section of remarks and explanation for each of the 10 species or groups. (Authors)

16199. Baramzin, N. A. 1972. A NEW INCUBATIONAL APPARATUS (Novyĭ inkubatsionnyĭ apparat). Rybnoe Khozyaĭstvo No. 6, p. 17. In Russian.

An incubator is described in which it is possible to load 100-120, 000 trout eggs in two layers. The size of the seven-frame apparatus is 450 x 350 x 400 mm. In apparatuses occupying an area of 1.5 m^2 one can incubate 1 million trout eggs.

16200. Uyeno, Teruya (Nippon Luther Shingaku Daigaku, 3-10-20 Osawa, Mitaka-shi, Tokyo, Japan). 1972. CHROMOSOMES OF OFFSPRING RESULTING FROM CROSSING COHO SALMON AND BROOK TROUT. Jap. J. Ichthyol., 19(3): 166-171. In English.

Chromosome numbers of the hybrids between Oncorhynchus kisutch (2n = 60) and Salvelinus fontinalis (2n = 84) were 2n = 60 in the cross O. kisutch ♀ X S. fontinalis ♂, and 2n = 72 in the reciprocal cross. The karyotype of offspring from the former cross was identical with that of the female parent, but the karyotype of offspring from the reciprocal cross was intermediate of karyotypes of both parents. The karyotype of S. fontinalis looked as most primitive among karyotypes of salmonid fishes ever reported. The evolution of the salmonid karyotype is also briefly discussed. (Auth.)

16201. Efford, Ian E., and Kanji Tsumura (Inst. of Resource Ecol., Univ. of Brit. Columbia, Vancouver 8, Canada). 1973. A COMPARISON OF THE FOOD OF SALAMANDERS AND FISH IN MARION LAKE, BRITISH COLUMBIA. Trans. Amer. Fish. Soc., 102(1): 33-47.

The gut contents of rainbow trout (Salmo gairdneri), kokanee (Oncorhynchus nerka), and two salamanders (Ambystoma gracile and Taricha granulosa) from Marion Lake were compared. The species found in these four predators were very similar but each predator concentrated on different prey. The kokanee concentrated on species present at the surface or in the water column, and the trout on larger benthos. The salamanders also fed on benthos but usually chose smaller size classes. In comparing the effect of the four predators, the average volume of food present by weight in the gut was multiplied by a proportional converter for the rate of passage through the gut, the mean meal size, and by the number of individuals in the population. The results suggested that Salmo gairdneri ate over half by weight (56%) of all the food taken by the four predators combined; kokanee and Ambystoma gracile were less important and consumed 25% and 19% respectively; and Taricha granulosa because of its low number and slow growth was unimportant (1%). (Authors)

16202. Shnarevich, I. D., and Ye. G. Sakhnenko (Chernovtsy St. Univ., USSR). 1971. DYNAMICS OF CAROTENOIDS IN FISH TISSUES AND ORGANS IN RELATION TO THE SEXUAL CYCLE. Hydrobiological Journal, 7(6): 77-80.

The carotenoid content of fish tissues and organs exhibits distinct seasonal changes, closely related to the sexual cycle. The carotenoids are redistributed in the course of sexual maturation. The amount of pigments in the eggs increases as spawning time approaches because they decrease in the muscles and liver. The dynamics of the carotenoid pigments in fish organs and tissues reflects the seasonal peculiarities of the maturation of eggs. It can serve as a test of maturity and time of spawning. (Authors' conclusions)

16203. Waluga, D., and J. Flis. 1971. CHANGES IN THE PERIPHERAL BLOOD IN CARP (Cyprinus carpio L.) UNDER THE INFLUENCE OF AMMONIUM LIQUOR (Zmiany we krwi obwodowej karpis (Cyprinus carpio L.) pod wplywem wody amoniakalnesj). Roczniki Nauk Rolniczych, 93(2): 87-94; Selected Water Resources Abstracts, 6(5): p. 63.

The changes in peripheral blood among carp were investigated during poisoning with ammonium liquor. The established set of changes showed the symptoms of acute hemolytic anemia. It was accompanied by a reaction having the features of pathological degeneration. The decrease of leukocytes led to absolute peripheral leukopenia with a simultaneous intensive granulocytosis of a reactive character.

16204. Sparks, Richard E., John Cairns, Jr., Roger A. McNabb, and Glenn Suter, II (Dept. of Biol. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1972. MONITORING ZINC CONCENTRATIONS IN WATER USING THE RESPIRATORY RESPONSE OF BLUEGILLS (Lepomis macrochirus Rafinesque). Hydrobiologia, 40(3): 361-369.

Measuring the cough frequency of bluegills by means of a cannula inserted through the snout into the buccal cavity is a good monitoring technique for zinc (and probably other heavy metals) because the response is quick, is proportional to the toxicant concentration and occurs at sublethal concentrations. (Authors' summ.)

16205. Wells, Marion R., and James D. Yarbrough (Dept. of Zool., Miss. State Univ., State College, Mississippi). 1973. IN VIVO AND IN VITRO RETENTION OF [^{14}C] ALDRIN AND [^{14}C] DIELDRIN IN CELLULAR FRACTIONS FROM BRAIN AND LIVER TISSUES OF INSECTICIDE-RESISTANT AND SUSCEPTIBLE Gambusia. Toxicology and Applied Pharmacology, 24(2): 190-196.

Aldrin and dieldrin-resistant and susceptible populations of mosquitofish (Gambusia affinis) were assayed for aldrin and dieldrin retention in particulate fractions of livers and brains following in vivo and in vitro treatment with [^{14}C] aldrin and [^{14}C] dieldrin. In the in vivo studies there was a highly significant

difference in retention between cell particulate fractions of susceptible and resistant fish brains. In the in vitro studies the corresponding difference was less or entirely absent. This study offers indirect evidence for a membrane barrier to both aldrin and dieldrin in the brains of resistant fish. (Authors)

16206. Marcello, Rocco Anthony, Jr., and R. Kirk Strawn (Dept. of Wildlife and Fisheries Sciences, Texas A&M Univ., College Station, Texas 77840). 1972. THE CAGE CULTURE OF SOME MARINE FISHES IN THE INTAKE AND DISCHARGE CANALS OF A STEAM-ELECTRIC GENERATING STATION, GALVESTON BAY, TEXAS. Texas A&M Univ. Sea Grant Publication No. TAMU-SG-72-206, 267 p.; Marine Fisheries Abstracts, 26(3): p. 29.

The demand for fishery products has been steadily increasing in the United States and around the world. Since the commercial fishing industry cannot meet this demand, fish farming has been advocated as a supplementary measure. Although fish farming has its merits, there are some limiting factors. The primary one is that some fish cannot be grown to marketable size in one growing season, therefore, they must be wintered. To protect against large mortalities due to low winter temperatures, utilization of thermal discharges from electric generating stations has been suggested. This study was undertaken to determine the feasibility of this suggestion. Several species of marine fishes, croaker (Micropogon undulatus), pinfish (Lagodon rhomboides), pompano (Trachinotus carolinus), white mullet (Mugil curema), pigfish (Orthopristis chrysoptera), Gulf kingfish (Menticirrhus littoralis), silver perch (Bairdiella chrysura), spot (Leiostomus xanthurus), and black drum (Pogonias cromis), were placed in cages in the intake canal, and croaker, pinfish, and pompano were placed in cages in the discharge canal of a steam-electric generating station on Galveston Bay, Tex., for determination of survival, food conversion, length-weight relationship, condition, and growth. Approximately 25 fish were placed in each of 45 cages, 30 cages in the intake canal and 15 cages in the discharge canal. Survival, feeding, food conversion, length-weight relationship and condition, and growth records were maintained for all species being cultured. A record of the hydrological data at the culture sites was also maintained. Each cage was 3 x 4 x 3 ft., constructed of 1 x 1/8-in. angle iron and 1/2 x 1-in. mesh galvanized welded wire (16 gauge), dip-treated to prevent corrosion, and had polystyrene flotation blocks attached lengthwise on two sides. A feeding ring 12 x 18 x 24 in. constructed of 1/8-in. mesh galvanized hardware cloth with top and bottom open was inserted in the top of each cage so that 20 in. of it extended into the cage interior. All fish were fed pelleted Purina Trout Chow daily, six times per week: pompano at about 5% of their total weight in a cage, all other species at about 3% of their total weight in a cage. After placing food in the feeding ring, the cage was tapped several times to notify the fish of its presence. Croaker, pinfish, pompano, white mullet, spot, and black drum cultured in the intake canal had a survival rate of 70%. Survival in the discharge canal was extremely poor, with an almost complete mortality of croaker and pompano. The mortality was attributed to gas-bubble disease. Although only preliminary data were obtained, using heated discharge to extend the growing season of fish during periods of low-water temperature is promising and deserves further study. Food conversion efficiency was greatest in the croaker and less than acceptable in all other species studied. Generally speaking, the length-weight relationship for almost all species studied were greater than those for naturally occurring fish. In almost every case, cage-cultured fish were heavier per any given length. Growth of all species of cultured fish was at least equal to, if not greater than, naturally occurring fish. Growth was slowed considerably during the winter months for the fish in the intake canal. The few surviving fish in the discharge canal (receiving the heated water) exhibited normal growth throughout the year.

16207. Hart, Bill (Coastal Zone Resources Corp., Wilmington, North Carolina). 1971. THE ECONOMIC IMPACT OF THE SPORT FISHING INDUSTRY IN MOREHEAD CITY, NORTH CAROLINA. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971 at Jekyll Island, Ga.; Coastal Plains Center for Marine Development Services Seminar Series No. 1, 1972, pp. 17-21.

16208. Grant, Blake F., and Paul M. Mehrle (Fish-Pesticide Res. Lab., Bur. of Sport Fish. & Wildl., Columbia, Missouri 65201). 1973. ENDRIN TOXICOSIS IN RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(1): 31-40.

In mature rainbow trout (Salmo gairdneri) receiving sublethal doses of endrin (4.3-145 μg/kg body wt/day in 0.215-7.25 mg/kg of food) for 163 days and then forced to swim for 1 hr, the insecticide affected serum electrolytes, osmolality, total protein, cholesterol, cortisol, lactate, glucose, liver glycogen, and growth. Forced swimming alone altered 9 of 16 serum parameters examined. Apparent increases in serum Na and Cl and significant increases in osmolality and liver glycogen were directly related to dosage. A biphasic distribution of phosphate, total protein, and cholesterol with dosage was apparent. Glucose was increased about 50% by 145 μg/kg but was unaffected by lower doses. Variance analysis of zone electrophoretic patterns disclosed an interaction between serum protein distribution and dose. Mobilization of liver glycogen was apparently inhibited by low doses and almost totally blocked by high doses. Correspondingly, trout given 14.5 μg/kg or more had lowered serum cortisol levels whereas the lowest dose elevated cortisol. Growth was inhibited appreciably by 145 μg/kg but not by lower doses. Visceral fat accumulated 4.8-8.7 μg endrin/g tissue in the 43 and 145 μg/kg exposures. We conclude that endrin caused dysfunction of physiologic processes critical to survival. (Authors)

16209. Gibbons, J. W., and D. H. Bennett (Athens Inst. of Ecology, Georgia Univ., Athens, Georgia). 1971. ABUNDANCE AND LOCAL MOVEMENT OF LARGEMOUTH BASS (Micropterus salmoides) IN A RESERVOIR RECEIVING HEATED EFFLUENT FROM A REACTOR. In: Savannah River Ecol. Lab. Annual Report No. SRO-310-1 (Pt 1), August 1971, pp. 90-99; Selected Water Resources Abstracts, 6(2): p. 72.

Ecological studies of the largemouth bass (Micropterus salmoides) were conducted in Par Pond, a South Carolina reservoir receiving heated water from a nuclear reactor. Systematic angling coupled with underwater observation and tag-release-recapture studies were used to compare the abundance of largemouth bass in heated and cool environments. More than 2500 largemouth bass were tagged in Par Pond, yet recaptures were made on less than 3 percent of the individuals. Comparisons between the heated and cool parts of the lake revealed population density differences between the two areas. Based on three independent indicators of population size, more bass inhabit the heated areas of the lake. The casting and underwater observation studies further substantiate the idea that the high densities observed in winter are a result of elevated temperatures rather than another environmental factor. Individual bass exhibit a high mobility in the reservoir with movement of more than 6 km being of frequent occurrence. The majority of individuals recaptured in the heated areas appear to have remained in the same place.

16210. Dziuk, L. J., and F. W. Plapp (Dept. of Entomol., Texas A&M Univ., College Station, Texas). 1973. INSECTICIDE RESISTANCE IN MOSQUITOFISH FROM TEXAS. Bull. of Environmental Contamination and Toxicology, 9(1): 15-19.

The present report from Texas confirms the Mississippi findings of insecticide resistance in Gambusia. In addition, we report evidence that urban, as well as agricultural, uses of insecticide may result in resistant Gambusia populations. Further, we observed a resistance pattern that is distinctly different from that found in Mississippi. (Authors' summ.)

16211. Nakatsukasa, Yasuo (Ube-Kojo High School, Ube City, Yamaguchi-ken, Japan). 1972. A FIBROMA FOUND IN THE CAUDAL PEDUNCLE OF A GOLDFISH. Jap. J. Ichthyol., 19(3): 199-201. In Japanese with English abstract).

A hypodermic tumor found in the caudal peduncle of a goldfish, Carassius auratus (Linnaeus), was histologically investigated. The tumor is composed of tumor cells and fibers. The latter consists of two kinds: one is thick and the other is fine. The tumor capsulated by the connective tissue is not infiltrative to muscle tissue. The tumor is regarded to be a fibroma.

16212. Malenkova, E. M., and V. K. Evtyukhova. 1972. EFFECTIVENESS OF ARTIFICIAL REPRODUCTION OF THE BALTIC SALMON AT LATVIAN PISCICULTURAL PLANTS (Effektivnost' iskusstvennogo vosproizvodstva baltiĭskogo lososya na rybovodnykh zavodakh Latvii). Rybnoe khozyaĭstvo, No. 6, pp. 23-25. In Russian.

The fishery of the Baltic salmon has been maintained in Latvia as a result of transition to artificial reproduction with use of the food mixture KRT as artificial feed. The young are reared for 1-1+ years of freshwater life to the stage of downstream movement. Analysis of the commercial return for 1969 showed that 87.4% of smolts at such age from artificial reproduction are returned, while with natural reproduction - only 16% of the fish. The market qualities of salmon from artificial and natural reproduction are approximately the same. The change to artificial reproduction provides real possibilities of preserving and expanding the fishery of the Baltic salmon.

16213. Uskova, Ye. T., and A. V. Chaykovskaya (Inst. of Hydrobiology, Ukr. Acad. of Science, Kiev, USSR). 1971. THE AMINO ACID CONTENT OF MUCUS FROM THE SKIN OF VARIOUS MARINE FISHES. Hydrobiological Journal, 7(5): 79-80.

The mucus from the skin of Black Sea fishes that exhibit different speeds has essentially the same amino acids. A species difference appears only in one particular acid. It is suggested that the variation in a single amino acid may alter the structure of protein molecules and significantly affect the drag on fish. (Authors' conclusions)

16214. Rydlo, Manfred. 1971. EVIDENCE OF Myxosoma cerebralis SPORES IN VARIOUS ORGANS OF RAINBOW AFFLICTED WITH WHIRLING DISEASE. "Osterreichs Fischerei" Zeit. f. die gesamte Fischerei, f. Limnol., 24(7); Fish Health News prepared at Eastern Fish Disease Lab., Kearneysville, West Virginia. Translated from German by P. B. Hoffman, 1972.

This is the first report concerning using digest methods to recover spores of Myxosporida. Pepsin at 0.5-1% in aqueous 0.3 - 0.5% hydrochloric acid was used at 40 grams tissue to 1 liter of digest fluid. Material was strained and the spores settled to the bottom in 10-20 hours. Pepsin-trypsin digest methods used in fish parasitology were first reported by F. G. Wallace (1939) J. Parasitol., 25(6): 491-494 and have been used extensively ever since. -- Glenn L. Hoffman

16215. Young, Parke H. 1973. PARTYBOAT LOGS SHOW HOW SKIN AND SCUBA DIVERS FARED--1965 THROUGH 1970. Calif. Fish and Game, 59(1): 62-72.

Diving logs obtained from California partyboats over the period 1965-1970 show 83,996 divers landed 199,466 fish (fish, mollusks, and crustaceans), averaging 2.4 fish per diver. Abalones, spiny lobster, rock scallop, California sheephead and kelp bass, in order, dominated the 6 years' catch. Southern California offshore islands were most favored by divers. Santa Catalina and Santa Cruz islands supported the bulk of diving effort.

16216. Meyer, F. P., and G. L. Bullock (Bur. of Sport Fish. & Wildl., Stuttgart, Arkansas 72160). 1973. Edwardsiella tarda, A NEW PATHOGEN OF CHANNEL CATFISH (Ictalurus punctatus). Applied Microbiology, 25(1): 155-156.

Edwardsiella tarda, an enteric, gram-negative bacterium, causes gas-filled, malodorous lesions in muscle tissue of channel catfish. Incidence and epizootiology of the disease are presented. (Authors)

16217. Tyler, A. V. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. ALIMENTARY TRACT MORPHOLOGY OF SELECTED NORTH ATLANTIC FISHES IN RELATION TO FOOD HABITS. Fish. Res. Bd. of Canada Technical Report No. 361, 23 p.

Alimentary tract morphology of the following fishes is described and depicted: thorny skate, Atlantic salmon, Atlantic codfish (young and adult), haddock, white hake (young), longhorn sculpin, sea raven, winter flounder and American plaice.

16218. Regier, Henry A., and H. Francis Henderson (Fish Stock Evaluation Branch, Dept. of Fish., FAO, Rome, Italy). 1973. TOWARDS A BROAD ECOLOGICAL MODEL OF FISH COMMUNITIES AND FISHERIES. Trans. Amer. Fish. Soc., 102(1): 56-72.

The paper brings together major inferences from: (1) classical limnology - lake and stream typology, the role of major abiotic variables; (2) fisheries limnology - Ryder's morphoedaphic index, Jenkins' reservoir findings, concepts of habitat niches; (3) studies of ecological structure of communities - succession, diversity, stability, variability, regulation; (4) recent developments concerning the effects of major cultural stresses on fish communities. A model is proposed to interrelate these and other concepts, and then relate them all to conventional fisheries practices and objectives. The model is directed at events and processes at the community level of organization and it is argued that much of fisheries theory and management practices of the future will perforce need to be directed at the community level. (Authors)

16219. Otto, Robert G., and Shelby D. Gerking (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1973. HEAT TOLERANCE OF A DEATH VALLEY PUPFISH (GENUS CYPRINODON). Physiological Zoology, 46(1): 43-49.

The heat tolerance of a new species of pupfish (Cyprinodon sp.) from Death Valley, California, was tested in the laboratory. Heat tolerance was evaluated by determining the upper incipient lethal temperature and critical thermal maximum (CTM) for fish acclimated to 5 C, 15 C, 25 C, and 35 C in fresh water 15, 30, and 45 °/oo salinity. The upper lethal temperature in fresh water rose asymptomatically from 28 C for fish acclimated to 5 to 38 C at an acclimation level of 35 C. The lethal limit was raised to 39 C at the maximum acclimation temperature at all three higher salinity levels. The CTM in fresh water rose from 27 C at an acclimation temperature of 5 to 43 C at an acclimation level of 35 C. Increased salinity raised the CTM substantially at low acclimation temperatures, but the effect was progressively reduced as acclimation levels were raised. Our results agree reasonably well with similar studies on other species of Cyprinodon and demonstrate that the pupfish has a higher heat tolerance than most other fishes which have been tested. Pupfish also tolerate broad temperature fluctuations; cold-adapted fish tolerate a temperature increase as great as 22 C before becoming visibly impaired. The ability to withstand high salinities is also unusual. It is suggested that heat tolerance of pupfish acclimated to cyclic fluctuations in temperature be studied. (Authors' summ.)

16220. Hamoir, G., R. Marechal, and R. Bassleer (Lab. of Biol., Fac. of Sci., Univ. of Liege, Liege, Belgium) 1973. ELECTRON SPIN RESONANCE SPECTRA OF WHITE, CARDIAC AND VARIOUS RED SKELETAL MUSCLES OF THE CARP, Cyprinus carpio L. Experientia, 29(1): 25-26.

Measurements of electronic paramagnetic resonance carried out up to the present on muscle have not taken into account the differentiation of this tissue into red and white muscles. We compared signals of white muscle, cardiac muscle and different red muscles of the carp. The white muscle shows a very weak intensity; the myocardium and different red muscles yield higher values in accord with their greater content of mitochondria. The red muscle of the lateral line is distinguished from the other red muscles however, by a signal around 2X more intense, due, as histological examinations reveal, to the presence in this case of melanocytes situated along connective bundles and blood capillaries.

16221. Gatz, A. John, Jr. (Dept. of Zool., Duke Univ., Durham, North Carolina). 1973. SPEED, STAMINA, AND MUSCLES IN FISHES. J. Fish. Res. Bd. Canada, 30(2): 325-328.

A new interpretation is offered of some of the classic experiments on swimming in fishes done by Bainbridge. It is suggested that certain aspects of his results can be explained best by recognizing the discrete functions of the red and white muscle fibers in fishes. Persons investigating swimming performance of fishes are cautioned to bear in mind these distinctions in future work. (Auth.)

16222. Gainiev, S. S., and V. A. Nazarenko. 1972. ESTABLISHMENT OF THE PELED AND PHYTOPHAGOUS FISHES IN KUIBYSHEV RESERVOIR (Vselenie pelyadi i rastitel'noyadnykh ryb v Kuibyshevskoe Vodokhranilishche). Rybnoe Khozyaistvo No. 7, pp. 15-17. In Russian.

Young of the peled, white amur, variegated- and white silver-carp have been reared successfully in ponds adjacent to Kuibyshev Reservoir, and have been stocked in the Reservoir to raise its productivity.

16223. Castell, C. H., and Barbara Smith (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1973. MEASUREMENT OF FORMALDEHYDE IN FISH MUSCLE USING TCA EXTRACTION AND THE NASH REAGENT. J. Fish. Res. Bd. Canada, 20(1): 91-98.

The use of the Nash test, in conjunction with TCA extraction, for measuring formaldehyde in fish muscle was made more quantitative. This was done by means of a "recovery factor" which took into consideration the percent of formaldehyde added to the muscle extracted by the TCA solution. The average recovery from 15 different samples of cod muscle was 51.3% with an SD of 5.6. Because of differences between species in capacity to bind formaldehyde, it would appear that a different "recovery factor" may be required for each species of fish. As heating muscle increases its ability to bind formaldehyde, recovery factors developed for use with raw muscle are not applicable to the same muscle after it has been cooked. The percentage of added formaldehyde that was recovered varied with variations in the procedures used in preparing the muscle, making the extract, and carrying out the Nash test. (Authors)

16224. Lönning, Sunniva, and Per Solemdal (Inst. of Physiol., Univ. of Bergen, Norway). 1972. THE RELATION BETWEEN THICKNESS OF CHORION AND SPECIFIC GRAVITY OF EGGS FROM NORWEGIAN AND BALTIC FLATFISH POPULATIONS. Fiskeridirektoratets Skrifter Serie Havundersøkelser, 16(3): 77-88.

Neutral buoyancy, size, and thickness and ultrastructure of the chorion were studied in eggs from populations of flatfish (Platichthys flesus and Limanda limanda) from western Norway and three localities in the Baltic: Kiel, the Arkona basin and Tvärminne. The observed differences in neutral buoyancy are probably caused by the differing thickness of the chorion and are correlated with the salinity in the area. The differences are thought to be the result of a long term selection process. (Authors)

16225. Stone, Richard (NMFS, Sandy Hook Marine Lab., Highlands, New Jersey). 1972. GENERAL INTRODUCTION TO ARTIFICIAL REEFS. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971, Jekyll Island, Ga., Coastal Plains Center for Marine Development Services, Seminar Series No. 1, pp. 1-3.

16226. Shotts, Emmet B., Jr., John L. Gaines, Jr., Larry Martin, and Annie K. Prestwood (Dept. Med. Microb., College Vet. Medicine, Univ. of Ga., Athens, Georgia). 1972. AEROMONAS-INDUCED DEATHS AMONG FISH AND REPTILES IN AN EUTROPHIC INLAND LAKE. J. Am. Vet. Med. Assoc., 161(6): 603-607; Fish Health News prepared at Eastern Fish Disease Lab., Kearneysville, West Virginia, p. 15.

The bacterial flora of water and poikilothermic animals in an inland eutrophic Florida lake was studied. Aeromonas hydrophila and A. shigelloides were the dominant organisms found in moribund and dead fish, turtles and lake water. Although effluent from municipal wastes and citrus processing plant enter the lake there are few coliform organisms present and motile Aeromonads almost in pure culture were recovered from the water's receiving these effluents. Authors suggest that the predominance of motile Aeromonads contributed to mortality among fish and other animals especially during periods of stress (low DO concentrations, high temp., etc.). Also since A. hydrophila and A. shigelloides have been demonstrated as pathogens of warm blooded animals, microbiological examination of highly eutrophic waters should be extended beyond those for presence of fecal bacteria. -- Graham L. Bullock

16227. Wells, LaRue, and Alberton L. McLain (Great Lakes Fish. Lab., Bur. of Sport Fish. & Wildl., Ann Arbor, Michigan 48107). 1973. LAKE MICHIGAN MAN'S EFFECTS ON NATIVE FISH STOCKS AND OTHER BIOTA. Great Lakes Fishery Comm., Ann Arbor, Mich., Technical Report No. 20, 55 p.

Man's activities have caused great changes in Lake Michigan in the past 120 years. Although changes in water chemistry and lower biota have been generally modest (except locally), those in native fish stocks have been vast. Exploitation, exotic fish species, and eutrophication and other forms of pollution all have played a role in bringing about the changes (mostly declines in abundance) in fish populations. Exploitation resulted in a noticeable reduction in abundance of certain native species (especially whitefish) soon after the establishment of the commercial fishery in the 1840's. By the 1930's the sturgeon and the two largest deepwater ciscoes (Coregonus nigripinnis and C. johannae) became severely depleted. Other species - whitefish (Coregonus clupeaformis), lake trout (Salvelinus namaycush), and lake herring (C. artedii) remained important commercially, but at a lower level of production than originally; greatly increased fishing effort and efficiency were required to maintain even these decreased catches. The catch of intermediate-size ciscoes held relatively stable, but again only through sharply increased fishing effort and efficiency. The earliest serious effects of exotic fish species on native fish stocks may have been during the 1930's, when smelt (Osmerus mordax) first became abundant. Powerful influences by exotics were not obvious, however, until the 1940's, when the sea lamprey's (Petromyzon marinus) predation on several species, particularly the lake trout, became critical. In the 1950's the sea lamprey was joined by the alewife (Alosa pseudoharengus), another exotic strongly deleterious to several native fish. The alewife apparently inhibited reproduction of deepwater ciscoes, yellow perch (Perca flavescens), deepwater sculpins (Myoxocephalus quadricornis), emerald shiners (Notropis atherinoides), and perhaps others (through competing with young, or feeding on them). At the same time, however, the alewife as a prolific forage fish has made possible the highly successful introduction of several species of salmonines. The effects of accelerated eutrophication and other pollution, although not always as easy to identify as the influences of other factors, were nevertheless clearly important as early as the mid-1800's. The first conspicuous contamination of Lake Michigan was by sawmill wastes, which covered spawning grounds in streams and around stream mouths. This type of pollution was particularly destructive to whitefish. Other forms of stream degradation (e.g., dams, deforestation of watersheds) although not strictly "pollution", must also have been detrimental to stream spawners. Heavy pollution in southern Green Bay (a large area of the bottom of which is now covered with anoxic gray sludge) probably has resulted in reduction in abundance of several species, e.g., lake herring and walleye (Stizostedion v. vitreum). Exploitation was largely responsible for the changes in Lake Michigan fish stocks before the invasion of the smelt, and probably before the invasion of the sea lamprey. The lamprey and alewife, however, have exerted a greater impact than the fishery on native fish populations in recent decades. Accelerated eutrophication and other pollution, although important, have not equalled the other factors in causing changes in native fish populations. (Authors)

16228. Parker, Faust R., Jr. (Dept. of Biol., The Univ. of Texas at Arlington, Arlington, Texas 76010). 1973. REDUCED METABOLIC RATES IN FISHES AS A RESULT OF INDUCED SCHOOLING. Trans. Amer. Fish. Soc., 102(1): 125-131.

Respiratory metabolism data on 15 species of fish representing six families indicate that individuals in a school experienced a reduction in metabolic rate when compared to the same individuals tested in isolation. The reduction in O_2 consumption appears to be the result of an interaction of a "calming effect" and a possible hydrodynamic advantage. Schooling and nonschooling species both exhibit this decreased metabolic rate in the grouped individuals. Between isolated and grouped individuals under laboratory conditions, there is no statistical difference in the regression slopes of respiratory metabolism on size. (Auth.)

16229. Schultz, R. Jack (Ecol. Section, Biol. Sci. Group, Univ. of Conn., Storrs, Connecticut 06268). 1973. UNISEXUAL FISH: LABORATORY SYNTHESIS OF A "SPECIES". Science, Vol. 179, pp. 180-181.

By hybridizing bisexual (gonochoristic) fishes, all-female clones have been produced that are comparable to those of a wild unisexual "species", Poeciliopsis monacha-lucida, living in northwestern Mexico. The laboratory unisexuals have consistently given birth only to female progeny for six generations. (Auth.)

16230. Takahashi, M., and F. Nash (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1973. THE EFFECT OF NUTRIENT ENRICHMENT ON ALGAL PHOTOSYNTHESIS IN GREAT CENTRAL LAKE, BRITISH COLUMBIA, CANADA. Arch. Hydrobiol., 71(2): 166-182.

In Great Central Lake when the lake water is cold, photosynthesis is controlled by temperature and light intensity. The concentration of nitrate (1-2 μg at l) decreases with increasing temperature. Under these conditions, the photosynthetic rate was usually 1-2 mgC/mgChlα/hr. By adding commercial grade fertilizers into the lake every week from the end of the spring to the middle of autumn, the photosynthetic maximum rose to an average of 4 mgC/mgChlα/hr. The effect of fertilizers on algal photosynthesis under conditions of different light intensities, temperature and nutrients was estimated by the use of the chlorophyll method. We simulated two situations, fertilized and unfertilized, with the aid of a computer model. Computed results indicated that there was no positive effect of fertilizer on daily photosynthetic rate below ca 15 m throughout the year and in the whole water column in December to March. The maximum stimulation was an approximate doubling of the unfertilized situation in the water above 10 m in July. On an annual basis, the effect of fertilization was to increase photosynthesis by about 160%, assuming the same amount of biomass in the both situations. (Authors)

16231. Davis, John C., and David J. Randall (Dept. of Zool., Univ. of Brit. Columbia, Vancouver 8, British Columbia, Canada). 1973. GILL IRRIGATION AND PRESSURE RELATIONSHIPS IN RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(1): 99-104.

In studies on 11 rainbow trout (Salmo gairdneri) 217.3±6.5 g, 14.0±0.5 C) fitted with rubber membranes for direct measurement of ventilatory water flow (V_G), buccal, cleithral, and differential pressure traces increased in amplitude as V_G rose from 40 to 160 ml/min. Ventilation rate remained steady at around 77 breaths/min in the V_G range 40-120 ml/min and rose to 90 breaths/min at a V_G of 175 ml/min. Oxygen uptake more than doubled as V_G rose from 40 to 120 ml/min. Calculated utilization of oxygen from the inspired water declined only slightly over this V_G range, indicating that large increases in nonrespiratory spillage of water (anatomical dead space) had not occurred. The calculated oxygen cost of breathing was low. Area mean differential pressure appeared closely related to V_G over the V_G range 40-160 ml/min. Area mean differential pressure increased from two- to four fold over this V_G range, depending upon which individual fish was examined. Over the V_G range 40-160 ml/min the calculated resistance of the gill sieve did not appear to decline although some variability was present and a variety of gill sieve resistances could be measured at a given V_G for each fish. It is concluded that changes in V_G are largely dependent on changes in mean differential pressures across the gills, with no marked decline in gill sieve resistance over the normal physiological range of V_G. (Authors)

16232. Mackey, A. P. (Zool. Dept., Univ. of Reading, England). 1972. AN AIR-LIFT FOR SAMPLING FRESHWATER BENTHOS. Oikos, 23(3): 413-415.

Air-lifts have been used since the nineteenth century for pumping water. A design is presented that can be used for sampling bottom fauna. Its main advantages are that it is light, cheap to construct, and can be used to sample most freshwater sediments. A preliminary sorting of material can be carried out while the sample is being taken. Test results are presented from a comparison between the air-lift and a Maitland corer. (Auth.)

16233. Mathur, Dilip (Ala. Coop. Fish. Unit, Auburn Univ., Auburn, Alabama). 1973. FOOD HABITS AND FEEDING CHRONOLOGY OF THE BLACKBANDED DARTER, Percina nigrofasciata (Agassiz), IN HALAWAKEE CREEK, ALABAMA. Trans. Amer. Fish. Soc., 102(1): 48-55.

In Halawakee Creek, Percina nigrofasciata showed two distinct feeding peaks; one in the morning and a higher one in late afternoon. Immature forms of Diptera, Ephemeroptera, and Trichoptera were dominant in the diet over the 24-hour period. Although these organisms were most abundant in drift during the night, most were eaten during daylight. Daytime feeding peaks suggests that P. nigrofasciata are visual feeders. Daily ration varied from 2.6 to 4.9% of the body weight. Optimum temperature range for maximal feeding in natural habitat was 17-23 C. Feeding rate was low or high, above or below this temperature range. The fish were highly insectivorous. Numerically and on the basis of percent frequency of occurrence dipteran larvae were the most important item in the diet throughout the year. Ephemeropteran nymphs constituted the bulk of the food by weight. Trichopteran larvae ranked third in importance. Other items which were eaten occasionally included copepods, cladocerans, amphipods, isopods, coleopteran larvae, and plecopteran nymphs. An almost complete absence of terrestrial food items and detritus (mud, sand, and gravel) and dominance of drift organisms in the diet suggests subsurface feeding. (Auth.)

16234. Clayton, J. W., W. G. Franzin, and D. N. Tretiak (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1973. GENETICS OF GLYCEROL-3-PHOSPHATE DEHYDROGENASE ISOZYMES IN WHITE MUSCLE OF LAKE WHITEFISH (Coregonus clupeaformis). J. Fish. Res. Bd. Canada, 30(2): 187-193.

Multiple isozymes of glycerol-3-phosphate dehydrogenase (L-glycerol-3-phosphate: NAD oxidoreductase, E. C. 1.1.1.8) have been resolved by starch gel electrophoresis of extracts of muscle tissue from lake whitefish (Coregonus clupeaformis). The isozyme electropherograms show that three kinds of subunit, A, B, and C, are synthesized in red muscle and two of these, A and B, are also found in white muscle. In red muscle the subunits evidently combine to form catalytically active dimers of the following types: AA, AB, BB, BC, and CC. In white muscle only the AA, AB, and BB dimers were observed. A genetic and molecular structure model is proposed for the glycerol-3-phosphate dehydrogenase (G-3-PDH) isozymes in white muscle of lake whitefish. On the basis of two alleles for A subunits and three alleles for B subunits, the model predicts a total of 18 distinct, electrophoretic G-3-PDH phenotypes for all possible AA, AB, and BB dimeric isozymes. The model has been confirmed by the results of a breeding experiment that tested the heritability of each of the five known alleles. A difference in the rate of heat inactivation of AA and BB isozymes was also interpreted as additional evidence for the unique genetic and molecular nature of the two kinds of subunits. Surveys of natural populations of lake whitefish revealed some marked variations in the frequencies of G-3-PDH alleles in fish from different geographical areas. The cisco (Coregonus artedii) also appears to have three "b" alleles for G-3-PDH. (Authors)

16235. Sundnes, Gunnar, and Per Bratland (Inst. of Mar. Res., Bergen, Norway). 1972. NOTES ON THE GAS CONTENT AND NEUTRAL BUOYANCY IN PHYSOSTOME FISH. Fiskeridirektoratets Skrifter Serie Havundersøkelser, 16(3): 89-97.

Field and experimental observations from herring (Clupea harengus) and char (Salmo alpinus) indicate that the swimbladder gas is not only "swallowed" from the atmosphere, but may also be deposited from the vascular system or tissue around the swimbladder lumen. (Authors)

16236. Smith, Larry (Ga. Game and Fish Comm., Brunswick, Georgia). 1972. CONSTRUCTION AND STUDIES OF AN ARTIFICIAL REEF OFF BRUNSWICK, GEORGIA. Proc. of Sport Fishing Seminar, November 18-19, 1971, Jekyll Island, Georgia, Coastal Plains Center for Marine Development Services Seminar Series No. 1, pp. 5-6.

16237. Sinnhuber, R. O., J. D. Castell, and D. J. Lee (Dept. Food Sci. and Tech., Oregon State Univ., Corvallis, Oregon 97331). 1972. ESSENTIAL FATTY ACID REQUIREMENT OF THE RAINBOW TROUT, Salmo gairdneri. Federation Proc. 31:1436-1441; Fish Health News prepared at Eastern Fish Dis. Lab., Kearneysville, West Virginia, 2(1): p. 16.

Since fish cannot biosynthesize linoleic acid (W^6) or linolenic acid (W^3) they must be obtained from the diet. This paper shows that the lenolenate series of fatty acids is essential for rainbow trout and that it should comprise about 1% of the dry weight of the diet. The signs of essential fatty acid deficiency are poor growth, elevated tissue levels of W^9 fatty acids, caudal fin necrosis, pale fatty liver, dermal depigmentation, increased muscle water content, shock syndrome, mitochondrial swelling, increased respiration rates of liver homogenates, heart myopathy and lowered hemoglobin. Linoleic acid has little effect on these signs, but linolenic acid can prevent or remedy all of them except dermal depigmentation.

16238. Hardwick, James E. 1973. BIOMASS ESTIMATES OF SPAWNING HERRING, Clupea harengus pallasi, HERRING EGGS, AND ASSOCIATED VEGETATION IN TOMALES BAY. Calif. Fish and Game, 59(1): 36-61.

Tomales Bay is an important central California habitat and a spawning ground for several species of fish. A minimum of 1,600 tons of herring enter the bay each winter to spawn. They lay at least 163 tons of eggs, primarily upon eelgrass, Zostera marina, which comprises 75% of the vegetation of the bay. Eggs also are deposited on rocks and algae. Herring eggs on edible seaweed are harvested, and it is recommended that this annual harvest not exceed 20 tons. (Auth.)

16239. Tanaka, Masaru (Dept. of Fish., Fac. of Agric., Kyoto Univ., Kyoto, Japan). 1972. STUDIES ON THE STRUCTURE AND FUNCTION OF THE DIGESTIVE SYSTEM IN TELEOST LARVAE - V. EPITHELIAL CHANGES IN THE POSTERIOR GUT AND PROTEIN INGESTION. Jap. J. Ichthyol., 19(3): 172-180. In Japanese.

The condition of the posterior gut (rectum) in 22 teleost postlarvae was compared with one another to observe changes in the epithelium after feeding. The posterior gut is distinguished from the mid-gut by the constriction with the sphincter. After feeding, many acidophilic granules which are well stained with eosine, orange G and azocarmine G, are found in the supranuclear region of epithelial cells at the posterior gut both in rearing and natural larvae. These granules are generally 1-6 μ in diameter and sometimes over 10 μ in well growing larvae of halfbeak and puffer. The larvae which have fed more actively have more numerous and larger granules, which are not in the lower half of the mucosal folds and the bottom region but are in the upper half. In some species the posterior gut is provided with villi-like mucosal projections different from mucosal folds in common species. These facts suggest that the appearance of acidophilic granules relates intimately with ingestion of nutrients from the gut lumen. Since these acidophilic granules show positive reactions in detecting phenol group, indolyl group, and guanidyl group, they may be proteins or the substances which are chiefly made of proteins. It is well known that in the new-born mammals intact protein ingestion is brought by pinocytosis to receive antibodies from their mothers through colostrum. Then, large globules which are stained with eosine appear in epithelial cells of the small intestine. The fact that these globules are similar to acidophilic granules of teleost larvae both in morphological and histochemical features indicates that proteins are ingested intactly in teleost larvae. At the transitional stage from larvae to juveniles when the gastric gland becomes functional and pyloric caeca differentiate, acidophilic granules gradually disappear. It is speculated that postlarval digestive system attains to the adult level not only in structure but also in function, and that according to the change in digestive mechanisms proteins are not ingested intactly in the posterior gut. Food items are quickly transported backward and are interrupted by the posterior constriction, and excreted from the anus in a short time. Based on these facts, it is conceivable that intact protein ingestion in the posterior gut plays an important role in protein ingestion at the postlarval stage. The fact that intracellular digestion which is

common to the lower groups of invertebrates is recognized in teleost larvae indicates the peculiarity of the larval digestive and absorptive mechanisms, and reflects the history of the developmental process of the animal digestive system. (Auth.)

16240. Chechenkov, A. V., and L. P. Ryzhkov (Northern Inst. of Oceanogr. and Fisheries, Petrozavodsk, USSR). 1971. RELATIONSHIP OF BODY SIZE AND CONTENT OF DRY MATTER AND WATER IN THE TISSUES OF THE VENDACE (Coregonus albula L.) TO ITS WEIGHT. Hydrobiological Journal, 7(5): 90-93.

The coefficients and equations given reflect the normal state of the vendace in nature and can serve as indicators of biological well-being when there is a change in living conditions in an inland water body or in the case of acclimatization.

16241. Murat, J. C., J. P. Parent, and A. Serfaty (Univ. Paul Sabatier, Lab. d'Ecophysiologie animale, Toulouse, France). 1973. STUDY OF THE ACTIVITY IN VITRO OF THE GLYCOGEN PHOSPHORYLASE OF THE CARP (Cyprinus carpio L.). [Etude de l'activite in vitro de la glycogene phosphorylase de la carpe (Cyprinus carpio L.)]. Experientia, 29(1): 36-37.

In this paper we give some values of glycogen phosphorylase activity of heart, red muscle and white muscle from the carp. We show that in vitro optimum temperature is 25°C for the fish, and not 30°C as in mammalians. We also made measurements with rat and tench liver, but it has been impossible, under the same experimental conditions, to observe normal release of inorganic phosphorus from G-1-P with carp liver. (Authors' summ.)

16242. Chittenden, Mark E., Jr. (Dept. of Environ. Sci., Rutgers, The State Univ., New Brunswick, New Jersey). 1973. EFFECTS OF HANDLING ON OXYGEN REQUIREMENTS OF AMERICAN SHAD (Alosa sapidissima). J. Fish. Res. Bd. Canada, 30(1): 105-110.

Oxygen tolerance was determined 0.25, 3, and 24 hr after introducing young American shad (Alosa sapidissima) to washtubs 7, 4, 2, 5, 2, and 2 days after previous disturbance in the holding tank. Dissolved oxygen at equilibrium loss and death varied from 1.1 to 8.0 and 0.9 to 5.7 mg/liter, respectively; and mean oxygen levels at equilibrium loss and death in the 3-hr X 2-day tests were 1.5-3 times higher than in any other handling combination. Present evidence indicates that the effects of handling American shad vary, with the intensity of excitement generated by handling seeming to determine whether the fish lives, dies immediately, or dies later. This phenomenon is probably responsible for difficulty in transporting and marking this species and for conflicting reports on oxygen requirements and salinity and low temperature tolerance. Mean oxygen levels with 99% confidence limits at equilibrium loss and death of unexcited individuals were 1.62 ± 0.13 and 1.28 ± 0.19 mg/liter, respectively. Virtually no individuals lost equilibrium or died until oxygen declined to 2.56 and 1.92 mg/liter, respectively. Nearly all lost equilibrium or died at 0.68 and 0.64 mg/liter, respectively. Field and laboratory evidence suggests that minimum daily oxygen levels of 2.5-3.0 mg/liter permit migration through polluted areas, but 4.0 mg/liter appears necessary in spawning areas. (Auth.)

16243. Langley, D. G. (Lab. Div., T. W. Beak Consultants, Ltd., Ontario, Canada). 1973. MERCURY METHYLATION IN AN AQUATIC ENVIRONMENT. J. Wat. Poll. Contr. Fed., 45(1): 44-51

Fish have been used to compare mercury methylation of sediment samples from a contaminated river under controlled laboratory conditions. The fish concentrated methylmercury in their bodies, and the increase over background levels was measured by gas-liquid chromatography. Different locations varied in methylating capacity by a factor of nearly 40. Methylation did not relate directly to mercury concentration in sediments. Deposition of various layers of fluorspar tailings on sediments showed that a 2- to 3-cm layer decreased methylation by about 80 percent. The rate of methylation from sediments was extremely slow, indicating that mercury-containing sediments would require many decades to purge themselves naturally to background levels. (Auth.)

16244. Lech, John J. (Dept. of Pharmacol., The Med. Coll. of Wisconsin, Milwaukee, Wisconsin). 1973. ISOLATION AND IDENTIFICATION OF 3-TRIFLUOROMETHYL-4-NITROPHENYL GLUCURONIDE FROM BILE OF RAINBOW TROUT EXPOSED TO 3-TRIFLUOROMETHYL-4-NITROPHENOL. Toxicology and Applied Pharmacology, 24(1): 114-124.

A polar ^{14}C metabolite was purified from bile of rainbow trout exposed to ^{14}C (ring-UL) 3-trifluoromethyl-4-nitrophenol (TFM). Analysis by thin-layer chromatography, UV-visible and infrared spectroscopy, gas chromatography, β-glucuronidase hydrolysis and mass spectroscopy indicated that the material was the glucuronide conjugate of unchanged TFM. The amount of metabolite isolated from the bile of eight 125-g fish represented the conversion of approximately 3% of the total amount of TFM in the tank water in 24 hr. (Auth.)

16245. Samilkin, N. S., and V. I. Vorob'ev. 1972. THE INFLUENCE OF CERTAIN MICRO-ELEMENTS ON THE DEVELOPMENT OF WHITE AMUR SPAWN. (Vliyanie nekotorykh mikro-elementov na razvitie ikry belogo amura). Rybnoe Khozyaistvo, No. 8, pp. 29-31. In Russian.

In experiments with incubating white amur spawn, cobalt at less than 0.00025 mg/l or manganese at 0.0098-0.015 mg/l had no effect. Copper at 0.05 mg/l increased mortality of the larvae. Copper sulfate caused weakening and premature rupture of the egg membrane. Zinc sulfate yielded positive results at 0.05 and 0.1 mg/l; concentrations above 0.1 mg/l markedly inhibited normal swelling of the egg membrane. The number of normally developing embryos in comparison with the control increased by 16-18% on the average, with zinc sulfate doses of 0.05 and 0.01 mg/l administered in the first 40 min. of incubation.

16246. Haines, Terry A. (Dept. of Fish. & Wildl., Mich. State Univ., East Lansing, Michigan 48823). 1973. AN EVALUATION OF RNA-DNA RATIO AS A MEASURE OF LONG-TERM GROWTH IN FISH POPULATIONS. J. Fish. Res. Bd. Canada, 30(2): 195-199.

The value of RNA-DNA ratio as a measure of long-term growth of fish populations under semi-natural conditions and when subjected to environmental manipulations was determined. Populations of carp and smallmouth bass of known age distribution were established in artificial ponds maintained at two fertility levels. After 15 months, population growth rates (as percent increase in weight) and RNA-DNA ratios of muscle tissue from selected fish were measured. Each species exhibited a range of population growth rates. The relation between population growth rate and individual fish RNA-DNA ratio for each species was significant. When reproduction occurred, the relation was not significant unless young-of-the-year fish were excluded from population-growth rate calculations. Age of fish was also found to have an important effect on RNA-DNA ratio, with the ratio being higher in younger fish. RNA-DNA ratio can be a reliable indicator of long-term population growth in fish when population age structure is known and recruitment is controlled. The method has potential for use in detecting response to environmental changes before growth rate changes become severe. (Auth.)

16247. Anderson, Richard O. (Missouri Coop. Fish. Unit, Univ. of Mo., Columbia, Missouri 65201). 1973. APPLICATION OF THEORY AND RESEARCH TO MANAGEMENT OF WARMWATER FISH POPULATIONS. Trans. Amer. Fish. Soc., 102(1): 164-171.

Balance in fish populations is an important concept in fisheries management. Research on the characteristics and dynamics of balanced and unbalanced bluegill (Lepomis macrochirus) populations suggests guidelines relative to growth rate, survivorship and recruitment which may be applied to other species such as gizzard shad (Dorosoma cepedianum). Regulations and stocking are important management techniques which may be applied to improve the state of balance and structure in fish populations. (Auth.)

16248. Vyatchanina, L. A. (Ukr. Fish. Res. Inst., Kiev, USSR). 1971. DYNAMICS OF FAT ACCUMULATION IN THE ROACH (Rutilus rutilus) OF KREMENCHUG RESERVOIR AS A FUNCTION OF MATURATION OF THE GONADS. Hydrobiological Journal, 7(6): 80-84

16249. Bennett, George W., and William F. Childers (Ill. Nat. Hist. Survey, Urbana, Illinois). 1972. THIRTEEN-YEAR YIELD OF SMALLMOUTH BASS FROM A GRAVEL PIT POND. J. Wildlife Mgmt., 36(4): 1249-1253.

A 1.21-acre gravel pit pond stocked with smallmouth bass (Micropterus dolomieui), F_1 hybrid crappie (Pomoxis nigromaculatus X P. annularis), and lake chubsuckers (Erimyzon sucetta) produced annual hook-and-line yields of 28 to 97 pounds per acre over a period of 13 years. The annual hybrid crappie yield was small, usually less than 6 pounds per acre of fish that ranged in weight from 0.38 to 1.16 pounds. Thus, small mouth bass made up the bulk of the catch, and their yields alone ranged from 27 to 94 pounds per acre per season with a 13-year average of 60.7 pounds per acre. The numbers of smallmouths caught annually ranged from 31 to 184 per acre, with an average of 90. The lowest average weight of the smallmouths caught in any one season was 0.48 pound and the highest for a season was 1.04 pounds. Survival of hybrid crappie spawn was so low that they have presented no problem of over-population and stunting so characteristic of the parent species when stocked in small ponds. No chubsuckers were taken by angling, but chubsucker fry were observed along the shore shallows from April through May of each year. This combination appears to be capable of maintaining itself indefinitely with variable fisherman use of around 130 man-hours per acre per year. (Authors)

16250. Champ, M. A., J. T. Lock, C. D. Bjork, W. G. Klussmann, and J. D. McCullough, Jr. (Texas A&M Univ., College Station, Texas 77840). 1973. EFFECTS OF ANHYDROUS AMMONIA ON A CENTRAL TEXAS POND, AND A REVIEW OF PREVIOUS RESEARCH WITH AMMONIA IN FISHERIES MANAGEMENT. Trans. Amer. Fish. Soc., 102(1): 73-82.

A pond located on the Texas A&M University range area, College Station, (1.78 surface ha, 40,427 m^3) was treated with anhydrous ammonia in November 1968, for evaluation of this technique for simultaneous fish eradication, pond fertilization, and aquatic vegetation control. This paper reports the effect of such treatment on pond ecology. Chemical, physical, and biological data were taken 1 week prior to, on the day of, and at selected intervals for 12 months following treatment. Ammonia nitrogen levels before treatment were 0.2 to 0.4 ppm. The day after treatment the ammonia nitrogen level stabilized to 37.7 ppm and gradually declined to 5.0 ppm after 3 months. The pH before treatment was 6.9. A maximum pH of 10.3 was recorded during treatment and it stayed above 9.0 for 2 weeks following treatment. Titratable carbon dioxide decreased as the pH and carbonates increased. Phytoplankton counts were reduced by 96% and zooplankton counts were reduced 99% following treatment. Rooted aquatic vegetation was decimated. Dead frogs and tadpoles were observed. The most adversely affected macroinvertebrates were crayfish and freshwater shrimp. A total fish kill was indicated since no live fish were taken by trawl, or seine, and none were observed after treatment. (Authors)

16251. Addison, R. F., R. G. Ackman, and J. Hingley (Fish. Res. Bd. of Can., Mar. Ecol. Lab., Bedford Inst. of Oceanog., Dartmouth, Nova Scotia, Canada). 1973. SEASONAL AND LOCAL VARIATIONS IN ODD-CHAIN FATTY ACID LEVELS IN NOVA SCOTIAN RAINBOW SMELT (Osmerus mordax). J. Fish. Res. Bd. Canada, 30(1): 113-115.

Odd-chain fatty acid (OCFA) levels in rainbow smelt (Osmerus mordax) from Jeddore Harbour, N. S., showed a pronounced seasonal variation during the period from spring 1969 to fall 1970, reaching a maximum of 20% total fatty acids in the January-March period, and falling to a minimum of approximately 2% total fatty in summer and fall. The variation appeared to be general, and occurred in all OCFAs. Analysis of smelt stomach contents suggested that OCFAs originated in the diet. Smelt caught in inlets adjacent to Jeddore Harbour showed no unusual accumulation of OCFAs in January, 1970. (Authors)

16252. Sigel, Michael M., Diana M. Lopez, Annie R. Beasley, and LaRoy S. Dietrich. 1971. VIRUS-CELL INTERACTION IN LYMPHOCYSTIS DISEASE OF FISH. In: Viruses Affecting Man and Animals, ed. by Sander and Green, St. Louis, Mo.; Fish Health News, 2(1): p. 16, 1973.

16253. Kudusov, E. A. 1972. TSUNAMIS AND THE REPRODUCTION OF STOCKS OF SALMONIDS. (Tsunami i vosproizvodstvo zapasov lososevykh ryb). Rybnoe Khozyaĭstvo, No. 11, 24-26. In Russian.

Every tsunami to a greater or lesser degree has led or will lead to reduction of the reproduction of salmonids in the area of Kamchatka Peninsula and the Kurile Islands.

16254. Smith, Stanley A., and David A. Bella (CH_2M/Hill, Redding, California). 1973. DISSOLVED OXYGEN AND TEMPERATURE IN A STRATIFIED LAKE. J. Wat. Poll. Contr. Fed., 45(1): 119-133.

Temporal and spatial variations of temperature and dissolved oxygen were measured in Triangle Lake in Oregon. The lake was relatively uniform in the horizontal direction and significantly stratified vertically. Diel dissolved oxygen variations were less than 0.5 mg/l in surface regions. Diel temperature variations resulted in a nocturnal density overturning extending to about 9 ft (3 m) in depth. Depth of summer diel overturning defined the lower boundary of the epilimnion and upper boundary of metalimnic dissolved oxygen maximum. Complete overturn did not occur during the mild winter of 1969-70, and low hypolimnetic dissolved oxygen values occurred the following summer. During summer months, desirable game fish habitats in the lake are restricted by temperature and oxygen conditions. (Authors)

16255. Köhler, D. (Humboldt-Univ. Berlin, Sek. Biol., Berlin, GDR). 1973. A BEHAVIOURAL AUDIOGRAM OF JUVENILE CARP. Experientia, 29(1): 125-127. In English and German.

The hearing curve of one-summer carp was determined by means of avoidance behavior. 3000 Hz (26 dB) was obtained as the upper hearing limit and 75 Hz as the "lower". The perception optimum lay between 900 Hz (-25 dB) and 400 Hz (-22 dB). At 250 Hz a striking decrease of sensitivity was to be observed. (Auth. summ.)

16256. Norris, James S., David O. Norris, and John T. Windell (Dept. of Biol., Univ. of Colo., Boulder, Colorado 80302). 1973. EFFECT OF SIMULATED MEAL SIZE ON GASTRIC ACID AND PEPSIN SECRETORY RATES IN BLUEGILL (Lepomis macrochirus). J. Fish. Res. Bd. Canada, 30(2): 201-204.

Rates of gastric acid and pepsin secretion into the gastric juice were examined in terms of enzymatic activity (measured spectrophotometrically as tyrosone released from hemoglobin substrate) and total gastric enzyme secretion (calculated from secretion of ^{14}C-labelled protein) at various intervals up to 9 hr following introduction into the stomach of one or two glass beads representing approximately 0.62 and 1.26% of the bluegill (Lepomis macrochirus) body weight, respectively. Observations of enzymatic activity and concentration suggested that gastric secretory reserves would have been depleted 6 hr after consuming a meal equalling 1.26% of the fish body weight. Decreased acidity of gastric juice 5 hr after ingesting two glass beads supported this interpretation. The importance of these data to efficiency and growth studies is discussed. (Authors)

16257. Wickham, Donald (NMFS, Pascagoula, Mississippi). 1972. DEVELOPMENTS IN MID-WATER REEFS. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971, Jekyll Island, Ga., Coastal Plains Center for Marine Development Services Seminar Series No. 1, p. 7.

16258. Leggett, William C. 1973. THE MIGRATIONS OF THE SHAD. Scientific American, 228(3): 92-98.

The largest member of the herring family, much prized as a food fish, moves between the sea and its river spawning grounds with remarkable precision. Its main guide appears to be temperature.

16259. Wheat, Thomas E., Gregory S. Whitt, and William F. Childers (Univ. of Ill. and Ill. Nat. Hist. Survey, Urbana, Illinois). 1972. HETEROSIS IN POPULATIONS OF INTERSPECIFIC SUNFISH HYBRIDS. Reprint from Amer. Zool., 12(3): Abstr. 205. Paper presented at: Summer Meeting of the Amer. Soc. of Zoologists, Aug. 27-Sept. 1, 1972, Minneapolis, Minnesota.

16260. Panchenko, S. E. 1972. ON THE ACCUMULATION OF PESTICIDES IN FISH. (O nakoplenii pestitsidov v rybe). Rybnoe Khozyaĭstvo, No. 12, pp. 31-32. In Russian.

Investigation was made of accumulation of organochlorine and organophosphorus pesticides in fish living in Karpievskiĭ Firth. The order of intensity of accumulation was as follows: northern pike > wild carp > rudd > European pikeperch > roach > tench > bream. Even insignificant presence of pesticides in the water of the Firth, not exceeding 0.05 mg/l, will result in the accumulation of organochlorine and organophosphorus substances in different organs of the fish and can be the cause of lowering of their reproductive capacity, and with specific conditions also their death.

16261. Hokanson, Kenneth E. F., J. Howard McCormick, and Bernard R. Jones (Environ. Protection Agency, Nat'l Wat. Qual. Lab., 6201 Congdon Blvd., Duluth, Minnesota 55804). 1973. TEMPERATURE REQUIREMENTS FOR EMBRYOS AND LARVAE OF THE NORTHERN PIKE, Esox lucius (Linnaeus). Trans. Amer. Fish. Soc., 102(1): 89-100.

Several bioassay methods, responses, and end points were evaluated for use in determining the temperature requirements of northern pike embryos. Large differences in maximum embryo survival to hatch occurred among experiments that could not be attributed to effects of water temperature alone. Emphasis was placed on evaluating the relative effects of temperature on embryo survival by our correcting for differences in fertilization success among experiments. The most variable end point among experiments was the optimum temperature, while the most reproducible end point was the median tolerance limit (TL50). The lower and upper TL50s were 6.9 and 19.2 C for normal hatch and 6.3 and 19.9 C for total hatch. The age of the embryo at the time of exposure had a great effect on these tolerance limits. Temperature shock, source of fish, and wet fertilization in hard and soft water had negligible effects on these tolerance limits. Recommendations were made for routine thermal bioassays for fish eggs. The 1-day upper TL50 for newly hatched and swimming yolk-sac larvae was 28.4 C when acclimated to 17.7 C. Both larval stages survived a lower limit of 3.2 C for 7 days. Newly hatched yolk-sac larvae were more sensitive than swimming yolk-sac larvae to 7-day exposures to high temperatures at all acclimation temperatures (6-18 C), and partial mortality occurred over a greater temperature range. Growth of larvae was maximum at 26 C and negligible below 7 C. The high larval growth at 26 C was offset by an increased mortality rate during the first 2 weeks of life; consequently, the net biomass change was highest at 21 C. (Authors)

16262. Vladykov, V. D. (Dept. of Biol., Univ. of Ottawa, Ottawa, Ontario). 1973. Lampetra pacifica, A NEW NONPARASITIC SPECIES OF LAMPREY (PETROMYZONTIDAE) FROM OREGON AND CALIFORNIA. J. Fish. Res. Bd. Canada, 30(2): 205-213.

A new nonparasitic species of Petromyzontidae, Lampetra pacifica, from streams of Oregon and California is described and illustrated. This species is distinguishable from Lampetra richardsoni, its nearest relative, by fewer myomeres, body proportions, pronounced pigmentation inside the buccal cavity, patterns of pigmentation of the head and tail, and geographical distribution. The description is based on an examination of 233 specimens (43 transformed individuals and 190 ammocoetes). (Auth.)

16263. Warshaw, Stephen J. (Osborn Mem. Labs, Yale Univ., New Haven, Connecticut). 1972. EFFECTS OF ALEWIVES (Alosa pseudoharengus) ON THE ZOOPLANKTON OF LAKE WONONSKOPOMUC, CONNECTICUT. Limnol. & Oceanogr. 17(6): 816-825.

The effects of predation by alewives (Alosa pseudoharengus) on the limnetic zooplankton of Lake Wononskopomuc, Connecticut, were examined over several years. Shifts in zooplankton composition and size distribution toward small forms were apparent 8 years after alewife introduction. A partial reversal of these effects, including an increase in the abundance of large species and a size increase in at least one species, Daphnia galeata mendotae, followed an alewife die-off. (Auth.)

16264. Kutty, M. N., and R. L. Saunders (Fish. Res. Bd. of Can., Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. SWIMMING PERFORMANCE OF YOUNG ATLANTIC SALMON (Salmo salar) AS AFFECTED BY REDUCED AMBIENT OXYGEN CONCENTRATION. J. Fish. Res. Bd. Canada, 30(2): 223-227.

As oxygen concentration is lowered, a point is reached, the critical oxygen level, at which juvenile Atlantic salmon (Salmo salar) stop swimming in a tunnel respirometer. At concentrations just above the critical level, salmon frequently lose position in the upstream end of the respirometer and fall back to the downstream end while still headed into the current. There appears to be a progressive decrease in locomotor activity, indicated by reduced tailbeat frequency, on approaching the critical concentration. Swimming performance of Atlantic salmon is more highly dependent on oxygen concentration than is that of rainbow trout (Salmo gairdneri), goldfish (Carassius auratus), or Tilapia. The critical oxygen level for salmon swimming at 55 cm/sec is about 4.5 mg/liter, in comparison with 2.0 for rainbow trout, 1.7 for goldfish, and 1.0 for Tilapia. Between the minimum speed at which a salmon swims steadily and the maximum of which the fish is capable, the critical oxygen level rises with increase in swimming speed. Stoppage of swimming at the critical level is not owing to fatigue; fish resume swimming within minutes of the oxygen level being raised only slightly. The high critical oxygen levels for salmon in relation to other species including rainbow trout, another salmonid, point up the need for maintenance of stringent water quality criteria for oxygen levels in salmon rivers. (Authors)

16265. Bumeisters, Yu. K., and A. R. Mitans. 1972. A TRAP FOR CALCULATION OF ATLANTIC SALMON SMOLTS. (Lovushka dlya ucheta pokatnikov Atlanticheskogo lososya). Rybnoe Khozyaĭstvo, No. 6, pp. 26-27. In Russian.

16266. Jester, Douglas B. (Dept. of Animal, Range & Wildl. Sciences, New Mexico State Univ., Las Cruces, New Mexico 88003). 1973. VARIATIONS IN CATCHABILITY OF FISHES WITH COLOR OF GILLNETS. Trans. Amer. Fish. Soc., 102(1): 109-115.

Gillnets of nine colors were compared with white nylon to determine effects of each color on catch rates of numbers and weights of 15 species of fishes in Elephant Butte Lake. Data were analyzed with mixed-model analysis of variance. Significantly different catch rates were compared, as fractions of unity (ratios), with rates in white nets. All colors afforded positive or negative selectivity for various species. Seasonal differences in catch rates between colored and white nets were found only in clear monofilament nets. Catch rates in monofilament nets were higher than in white nets during summer when water transparency was low. Catch rates in white nets were higher from September through March when water was relatively clear and monofilament nylon appeared to break light into a spectrum. Most significant differences consisted of reduced catches in colored nets. Thus, use of colors allows selection of species along with handling smaller numbers of unwanted fish. Brown nets caught more catostomids and carp, and fewer game fish, than white nets, and thus offer advantages for commercial fishing and fish control efforts. Seasonal alternation of clear and brown nets also offers possibilities for commercial fishing and fish control. Six species of small sunfishes were caught at higher rates in orange nets than in any other color and large largemouth bass were taken selectively in yellow nets. (Auth.)

16267. Belokopytin, Yu. S. 1973. CHANGE OF SOME BLOOD INDICES OF THE DON PIKEPERCH DURING SPAWNING. (Izmenenie nekotorykh pokaza telei krovi Donskogo sudaka v nerestovyi period). Rybnoe Khozyaĭstvo, No. 1, pp. 19-20. In Russian.

Investigations were made of the blood hemoglobin and leucocyte formula in pikeperch broodfish used for artificial propagation. Brood pikeperch with a hemoglobin content of 40% and lower do not respond to injection and the leucocyte formula in them does not change. Such pikeperch cannot be utilized for reproduction. Pikeperch sick with pop-eye, also cannot be recommended as broodfish. (Auth.)

16268. McIntyre, J. D., and J.-M. Blanc (Ore. Coop. Fish. Unit, Dept. of Fish. & Wildl., Ore. State Univ., Corvallis, Oregon 97331. 1973. A GENETIC ANALYSIS OF HATCHING TIME IN STEELHEAD TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(1): 137-139.

The elapsed time from fertilization through hatching for steelhead trout (Salmo gairdneri) was obtained from groups of eggs that were fertilized according to a factorial breeding plan in which 24 males were each mated to each of 10 females. Data were obtained from the eggs of 240 crosses held in an incubator through hatching and from replicated crosses held in an incubator for most of the incubation period, then in troughs. Estimated heritabilities for hatching time were 0 and 0.23, respectively, for these data, the differences being of additive genetic origin. Because of a significant genotype-environment interaction, it was suggested that hatching may have been controlled by different genetic mechanisms in the two environments. (Authors)

16269. Bauchot, Roland, Roland Platel, Jean-Marc Ridet, and Michel Thireau (Lab. de Neuroanatomie comparée, Univ. de Paris 7, France). 1973. THE BRAIN OF THE RAINBOW TROUT (Salmo gairdneri, PISCES, TELEOSTEI, SALMONIDAE). LOOKING FOR A REFERENCE SIZE FOR QUANTITATIVE STUDIES. [L'encéphale de Salmo gairdneri Richardson (Truite Arc-en-ciel) (Pisces, Teleostei, Salmonidae). Recherche d'une grandeur de référence pour des études quantitatives]. Acta Zoologica, 54(1): 53-64. In French with English and German abstracts.

The variability of the brain weight in the rainbow trout (Salmo gairdneri) is less than that of the body weight. The variability of the lengths studied (standard, total, preanal and cephalic lengths) is comparable and approaches that of the body weight's cubic root. The intraspecific brain/body weight shows an allometric coefficient of .472, a little more than in Reptilia (Saurians: .39) and much more than in Mammalia (.23). The study of the various relationships brain weight/lengths and lengths/body weight shows that the preanal length is the best, and the cephalic length the worst in each case. It is therefore possible to substitute for the body weight this preanal length, the variation of which following most closely, in our instantaneous sample, both body- and brain weights' variations. (Authors)

16270. Prince, Eric D. (Humboldt State College, Arcata, California). 1972. ARTIFICIAL REEF DEVELOPMENTS ON THE WEST COAST OF THE UNITED STATES. Proc. of Sport Fishing Seminar Nov. 18-19, 1971, Jekyll Island, Ga., Coastal Plains Center for Marine Development Services Seminar Series No. 1, p. 11.

16271. Moeller, George H., and John H. Engelken (Forest Service, NE Forest Exper. Sta., Syracuse, New York). 1972. WHAT FISHERMEN LOOK FOR IN A FISHING EXPERIENCE. J. Wildlife Mgmt., 36(4): 1253-1257.

Personal interviews were conducted with 100 fishermen to determine the relative importance of eight selected factors that influence the success of a typical 1-day fishing trip. Elements of the natural environment - water quality, natural beauty, and privacy while fishing - were consistently rated as the most important factors influencing fishing enjoyment. Size and number of fish caught, weather conditions and ease of access to fishing waters were rated of moderate importance. Facilities available were rated as of low importance. Few differences were found between factor rankings for stream and for lake fishing experiences. Shifts in the importance of factors across different groups of fishermen were also investigated. Results of the study indicate that the concept of fishery management should be broadened to incorporate environmental management, if quality fishing experiences are to be provided. (Authors)

16272. Hourston, A. S., D. N. Outram, and F. W. Nash (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. MILLIONS OF EGGS AND MILES OF SPAWN IN BRITISH COLUMBIA HERRING SPAWNINGS 1951 TO 1970 (REVISED, 1972). Fish. Res. Bd. of Canada Technical Report No. 359, 10 p. + tables.

16273. Schachte, John H., Jr., and Emilio C. Mora (Dept. of Fish. and Allied Aquacultures, Ala. Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1973. PRODUCTION OF AGGLUTINATING ANTIBODIES IN THE CHANNEL CATFISH (Ictalurus punctatus) AGAINST Chondrococcus columnaris. J. Fish. Res. Bd. Canada, 30(1): 116-118.

Fingerling channel catfish (Ictalurus punctatus) were injected subcutaneously and intramuscularly with an injectable Chondrococcus columnaris antigen to test for the production of agglutinating antibodies. The test fish of both routes of injection had a mean titer of 1:4337. No significant differences in titers between the two routes of injection were determined. (Authors)

16274. Lux, Fred E. (NMFS, Northeast Fisheries Center, Woods Hole, Massachusetts 02543). 1973. WHITE SPOTTING IN THE 1959 YEAR-CLASS OF GEORGES BANK WINTER FLOUNDER, Pseudopleuronectes americanus (Walbaum). Trans. Amer. Fish. Soc., 102(1): 83-88.

Winter flounder with white spots on the eyed side were unusually common among fish of the 1959 year-class caught on north-central Georges Bank in 1964, 1965, and 1966. The water on eastern Georges Bank was considerably colder than normal in the spring of 1959 when young flounder were developing. A possible relationship between lowered development temperature and white-spotting is suggested. (Auth.)

16275. Gard, Richard (School of Forestry and Conserv., Univ. of Calif., Berkeley, California). 1972. PERSISTENCE OF HEADWATER CHECK DAMS IN A TROUT STREAM. J. Wildlife Mgmt., 36(4): 1363-1367.

The condition of a series of small dams constructed in 1957 in the headwaters of Sagehen Creek, California, was determined in 1969. Changes in a population of brook trout (Salvelinus fontinalis) introduced into the new ponds were also assessed. After a 12-year period, about half of the dams were in good to excellent condition. Average depth of the ponds decreased from 16 to 10 inches, but holes 9-13 inches deep were created below the dams. The standing crop of trout of catchable sizes ($\geqslant$ 100 mm in length) was estimated to be 93 trout weighing 9.6 pounds (equivalent to 394 trout per acre weighing 41 pounds). This is comparable to the standing crop in 6 miles of stream below the headwaters of Sagehen Creek. The cost of constructing the dams and introducing the trout was $154, or $12.80 per year over the 12-year period. (Auth.)

16276. Kristoffersson, Rolf, Saara Broberg, and Aimo Oikari. 1972. EFFECT OF TEMPERATURE CHANGE ON SOME BLOOD CONSTITUENTS AND OSMOTIC BALANCE IN THE PIKE (Esox lucius L.) IN BRACKISH WATER. Annales Zoologici Fennici, 9(4): 212-218.

Pike were acclimated to water temperatures of 6°C and 16°C for 16 days without food. The temperatures were then reversed for 12 hours. Blood and tissue samples were taken at both temperatures after acclimation, and 2 days, 1 week and 2 weeks after the temperature change. These temperature changes of 10°C did not affect Hb, Hcr, or plasma total protein concentrations. A clear change was seen in plasma potassium and inorganic phosphate levels at both temperatures and in plasma and muscle tissue water contents of pike transferred from 6°C to 16°C. A transitory decrease in plasma sodium and chloride values, and increase of plasma water content were found in pike after 1 week at 6°C. (Authors)

16277. McIntyre, J. D. (Oregon Coop. Fish. Unit, Oregon State University, Corvallis, Oregon). 1973. TOXICITY OF METHYL MERCURY FOR STEELHEAD TROUT SPERM. Bulletin of Environmental Contamination and Toxicology, 9(2): 98-99.

Concentrations of methylmercuric chloride of 1.0 ppm and greater reduced steelhead trout sperm viability as compared to the control. Reductions in sperm viability increased sharply at concentrations greater than 1.0 ppm.

16278. Ginetz, R. M., and P. A. Larkin (Inst. of Animal Resource Ecology, Univ. of Br. Columbia, Vancouver, 8, British Columbia, Canada). 1973. CHOICE OF COLORS OF FOOD ITEMS BY RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 30(2): 229-234.

Rainbow trout in artificial stream situations were offered seven colors of dyed rainbow trout eggs in all combinations of two colors. Against a pale, greenish-blue background, in daylight, the color preference was: blue, red, black, orange, brown, yellow, and green. This order largely reflected contrast with background color; but, in addition, there were preferences for certain colors. Particular color combinations such as yellow and black, and yellow and blue, resulted in significantly higher total consumption. When background color was varied, preference was low for the color of eggs that matched the background, but the effect was not statistically demonstrable. At low light intensities the order of preference for various colors was yellow, red, blue, and black. The results collectively indicate keen color discrimination in rainbow trout and preferences for particular colors in particular environmental settings. These findings could have useful application to field situations where it is desirable to modify rates of predation on salmon fry by presenting other kinds of food to satiate predators. (Authors)

16279. Giblin, F. J., and Edward J. Massaro (Dept. of Biochem., State Univ. of New York at Buffalo, Buffalo, New York). 1973. PHARMACODYNAMICS OF METHYL MERCURY IN THE RAINBOW TROUT (Salmo gairdneri): TISSUE UPTAKE, DISTRIBUTION AND EXCRETION. Toxicology and Applied Pharmacology, 24(1): 81-91.

The tissue distribution, rate of uptake and concentration of 203 Hg-labeled methylmercury was investigated in 20 different tissues/organs over a period of 100 days following a single intragastric dose of 0.5 mg Hg/kg body weight. Mercury content was analyzed by gamma scintillation spectrometry. After 1 hr, mercury concentration factors > 0.1 were detected in the blood, heart, liver, spleen and kidney (a concentration factor (CF) of 1.0 equals mercury concentration in dose). Highest mercury concentrations ($CF > 7.0$) were observed in the blood (at 7 days) and spleen (at 14 days). After 100 days, the CF of the blood was > 2.0 and the CF values of the spleen, kidney and liver were > 1.0. Maximum CF values were reached in the skeletal muscle, brain and lens after 34, 56 and > 90 days, respectively. Maximum values were reached in most other tissues/organs at approximately 7 days. Skeletal muscle appeared to function as a reservoir for methyl mercury and accumulated 50% of the dose from 34 to 100 days post administration. Methyl mercury accumulation in the brain was limited to 0.1% of the dose. The rate of mercury excretion appeared to be biphasic as a result of a slow elimination from the skeletal muscle relative to the other tissues/organs. Employing both the slow and fast rate, the half-retention time for methyl mercury in rainbow trout was estimated to be > 200 days. (Authors)

16280. Gibson, James R., and J. Larry Ludke (Dept. of Zool., Mississippi State Univ., State College, Mississippi). 1973. EFFECT OF SKF-525A ON BRAIN ACETYLCHOLINESTERASE INHIBITION BY PARATHION IN FISHES. Bulletin of Environmental Contamination and Toxicology, 9(3): 140-142.

Exposure of non-pretreated fish to 200 ppb parathion for 10 hr produced 58.6, 83.7 and 80.1% inhibition of ACLE activity in brains of shiners, green sunfish and bluegills respectively. Fish pretreated for 24 hr in 1 ppm SKF-525A solution prior to exposure to 200 ppb parathion for 10 hr showed depressions in brain ACLE activities of 52.0, 70.2, and 82.0% respectively for shiners, green sunfish and bluegills. SKF-525A alone did not alter ACLE activity. The level of protection afforded by SKF-525A pretreatment is significant ($p = .05$) for shiners and green sunfish. SKF-525A pretreatment did not protect bluegill sunfish ACLE. (Authors)

16281. Brown, James (N. C. Dept. of Nat. and Economic Resources, Morehead City, North Carolina). 1972. THE ESTUARINE SYSTEM IN NORTH CAROLINA - ITS USES AND MISUSES. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971, Jekyll Island, Ga., Coastal Plains Center for Marine Develop. Services Seminar Series No. 1, pp. 23-25.

16282. Havey, Keith (Maine Dept. of Inland Fish. & Game, Machias, Maine). 1973. RELATIVE RECOVERIES OF HATCHERY-REARED LANDLOCKED SALMON PLANTED AT DIFFERENT AGES AT SCHOODIC LAKE, MAINE. Trans. Amer. Fish. Soc., 102(1): 121-124.

Relative recoveries of landlocked salmon Salmo salar planted at ages 0+ (fall), I (spring) and I+ (fall) were compared by analysis of variance and a multiple range test. Data were collected from angler catches (1963-69) and from trap net catches (1963-70). Sample sizes were 987 salmon from angling and 1,018 salmon from netting. The analysis of variance revealed a significant difference in recoveries of salmon of different ages at planting, and the Student-Newman-Keuls multiple range test showed that the significant difference was between age 0+ and age I+ salmon. At Schoodic Lake, comparable sport fisheries could be provided by stocking either 1,000 age I+ salmon or 2,800 age 0+ salmon. The smaller salmon would cost only 70% as much as the larger. (Auth.)

16283. Westrheim, S. J. (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1973. AGE DETERMINATION AND GROWTH OF PACIFIC OCEAN PERCH (Sebastes alutus) IN THE NORTHEAST PACIFIC OCEAN. J. Fish. Res. Bd. Canada, 30(2): 235-247.

Age was determined by means of otoliths of juvenile and adult Pacific Ocean perch (Sebastes alutus) collected during 1963-69 in the northeast Pacific Ocean, from Oregon to Unalaska Island, Alaska. Consistency of otolith readings between two readers varied inversely with numbers of translucent (or opaque) zones – from 100% agreement for 0-zone otoliths to 23% for 19-zone otoliths. Variability in zone counts between two readers was not great – 85% $\pm$ 1 zone for 3- to 24-zone otoliths – and the dispersion was near-normal about zero. Validity of otolith readings was established by demonstrating the annual formation of the translucent zone for juvenile fish, and by detecting the temporal passage of dominant year-classes among juveniles and adults. Age-length relationship varied inversely with depth off British Columbia, and inversely with latitude (or longitude) in the study region. Off Vancouver Island (48°48 N lat), two partially mixed stocks with near-opposite seasonal availability maxima were delineated, from bathymetric age-length and catch-rate data. Latitudinally, there was a sharp discontinuity in the age-length relationship at Dixon Entrance (54°40 N lat). Ranges of von Bertalanffy growth parameters were as follows: L_∞, 37.2-48.2; K, 0.078-0.169; and t_o, -0.4 to -1.8. No geographical trend was evident for any parameter. Values of L_∞ were larger for females, while values of K were smaller. Considerable variation in parameter values exists among studies on Pacific Ocean perch from the western Gulf of Alaska. Age-weight relationship was generally sigmoid in shape. Values of W_∞ ranged from 791 to 1686 g. Annual weight increments were maximal at ages 7-11. (Auth.)

16284. Bjerk, J. E. (The Veterinary Coll. of Norway, Dept. of Pharmacol. and Toxicol., Oslo, Norway). 1973. RESIDUES OF DDT IN COD FROM NORWEGIAN FJORDS. Bull. of Environmental Contamination and Toxicology, 9(2): 89-97.

Samples of cod from four fjords located at the southwestern coast of Norway have been analyzed for DDT residues. At locality A there are large fruit orchards and a small forest nursery. At C there are fruit orchards, while at B there is a forest nursery only. The fourth locality, D, had no known source of contamination. At A samples were collected at intervals during the spring of 1970. The DDT content in cod liver in samples from A and C was high. The mean values of 10-15 specimens ranged between 12 and 40 ppm, calculated on a wet weight basis, and between 26 and 99 ppm, calculated on the basis of extractable lipids. Three specimens of cod showed residue levels of 90-135 ppm DDT in liver tissue. DDT values in cod from the two other localities were less than 5 ppm. The specimens from A were caught at three sublocalities, and it was found that DDT levels decreased as one moved away from the head of the fjord, where the majority of fruit orchards are located. Significant correlations were found between fish size and DDT content in liver tissue, but not in the sample from locality D. The correlations were destroyed during the spring breakup, the DDT content increasing during this period. o,p'-DDT was also found in samples taken during May and June. The high DDT levels are attributed to the runoff from fruit orchards, which are located on steep slopes in this mountainous area. (Auth. summ.)

16285. Smith, Stanford H. (Great Lakes Fish. Lab., Ann Arbor, Michigan 48107). 1973. APPLICATION OF THEORY AND RESEARCH IN FISHERY MANAGEMENT OF THE LAURENTIAN GREAT LAKES. Trans. Amer. Fish. Soc., 102(1): 156-163.

The Great Lakes have a high potential for the conduct of research and useful application of research findings, but the history of the Great Lakes indicates that extensive research and intensive management have failed to prevent deterioration of the fisheries. At times the research was not done before a loss occurred, or did not provide the information needed to solve a problem, or was not interpreted to indicate a need for corrective action. Three examples are used to illustrate these problems: (1) Sea lamprey (Petromyzon marinus) research was not initiated until 50 years after the destructiveness of the sea lamprey was recognized, and control measures were not developed or applied until species most vulnerable to the lamprey had been greatly reduced or eliminated. (2) Most research on the alewife (Alosa pseudoharengus) has been directed toward determining why large numbers of alewives die during the spring and summer, but has not provided the information most urgently needed by management to use alewives to best advantage, or to reduce the biological or human problems that alewives cause. (3) After a study during 1926-30 to determine if pollution was affecting fish in Lake Erie, it was concluded that the detrimental effects of pollution in certain regions were offset by the benefits of enrichment in other areas, but managers were not warned that areas of pollution might expand, and eventually influence the entire lake. The Great Lakes ecosystem is complex and in a state of rapid change. Thus, the outcome from the application of theory is uncertain at best and there can be no assurance that the desired results will be attained. The programs for sea lamprey control and salmonid restoration are a current example of difficulty in application of theory in management. Superficially the sea lamprey appears to be under control and salmonids have been restored. The post-control abundance of sea lampreys, however, is equal to the abundance that caused the initial collapse of the lake trout (Salvelinus namaycush), and there is evidence that the damage lampreys are inflicting on lake trout is as heavy as it was in the pre-control period. Also, in the presence of an abundance of hatchery-reared salmonids, the lamprey is reproducing and thriving as well as or better than it did during its initial population explosion, and indications are that it will increase rather than decrease under the present method and level of control. Successful application of theory and research to fishery management has always been impeded by lack of continued and close coordination among some 30-40 state, provincial, and federal governmental units that have varying degrees of influence on fishery programs of the Great Lakes. Frequently agreements that have been reached among conservation agencies were not sustained by legislative units, or were nullified by organizational changes. As a result, conflicting approaches were sometimes taken by management agencies with jurisdiction in different areas of the same lake. Sustained and compatible management objectives and practices can, however, contribute to greater stability, and optimum usefulness and productivity. (Auth.)

16286. Williams, P. M., and H. V. Weiss (Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, La Jolla, California 92037). 1973. MERCURY IN THE MARINE ENVIRONMENT: CONCENTRATION IN SEA WATER AND IN A PELAGIC FOOD CHAIN. J. Fish. Res. Bd. Canada, 30(2): 293-295.

Mercury in seawater, in a pelagic food chain, and in bottom sediment was determined at a single station 430 km southeast of San Diego, California. The concentration of mercury in zooplankton slightly increased with depth of collection. The mercury content in almost all of the higher trophic levels of organisms collected at greater depths was indistinguishable from the concentration of mercury in zooplankton at these depths. Mercury concentration in the seawater column was essentially constant below 100 m and significantly higher at the surface. This vertical profile of mercury content is not ascribable to biological activity. (Authors)

16287. Larsson, Åke L. (Dept. of Zoophysiol., Univ. of Goteborg, Fack, Goteborg, Sweden). 1973. METABOLIC EFFECTS OF EPINEPHRINE AND NOREPINEPHRINE IN THE EEL Anguilla anguilla L. General and Comparative Endocrinology, 20(1): 155-167.

16288. Stasko, A. B., and S. M. Polar (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1973. HYDROPHONE AND BOW-MOUNT FOR TRACKING FISH BY ULTRASONIC TELEMETRY. J. Fish. Res. Bd. Can., 30(1): 119-121.

An inexpensive, do-it-yourself hydrophone for tracking aquatic animals is described. It can be used with or without a preamplifier, on small or large boats. A new mounting arrangement used on the bow of a 25-m tracking vessel is discussed. It was used successfully in coastal waters at cruising speeds up to 9 knots (5 m/sec) and at slow speeds during rough weather in 30-knot (15.3 m/sec) winds. (Authors)

16289. Freeman, H. C., and D. R. Idler (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1973. EFFECTS OF CORTICOSTEROIDS ON LIVER TRANSAMINASES IN TWO SALMONIDS, THE RAINBOW TROUT (Salmo gairdnerii) AND THE BROOK TROUT (Salvelinus fontinalis). General and Comparative Endocrinology, 20(1): 69-75.

The effects of cortisol and cortisone on liver glutamic-oxaloacetic transaminase (GOT) and glutamic-pyruvic transaminase (GPT) activities in two species of salmonids, the rainbow trout (Salmo gairdnerii) and the brook trout (Salvelinus fontinalis) were determined. Cortisol and cortisone increased liver GPT activity. Cortisone did not increase GOT activity and cortisol increased GOT activity only at high concentrations. Fish treated with cortisol lost nearly twice as much weight as did cortisone-treated and control fish. Cortisol was converted to cortisone, in vivo, but cortisone was not converted measurably to cortisol. It is concluded that cortisone was biologically active in these salmonids. It is suggested that corticosteroids have an important part to play in the catabolism of protein for the provision of metabolic energy in these salmonids. (Authors)

16290. Symposia of the Zoological Society of London No. 30. 1972. DISEASES OF FISH. The Zool. Soc. of London, Academic Press, London and New York, 380 p., edited by L. E. Mawdesley-Thomas; Fish Health News, 2(1): p. 17.

This Symposia dedicated to Dr. Stanislas F. Snieszko, Eastern Fish Disease Lab., contains chapters as follows: Progress in fish pathology in this century, by S. F. Snieszko; Some aspects of mycobacterial infections in fish, by H.-H. Reichenbach-Klinke; The principal aspects of bacterial fish diseases in Italy, by P. Ghittino; Infectious dropsy in carp - a disease complex, by N. N. Fijan; Ulcerative dermal necrosis (UDN) of salmon (Salmo salar L.), by Ronald J. Roberts; Some disease of trout in Denmark, by N. O. Christensen; Haematological techniques and the immune response in rainbow trout, by George W. Klontz; Studies on the haematology of the Atlantic Salmon (Salmo salar L.) by D. A. Conroy; Some characteristics of antibodies in the primary immune response of rainbow trout (Salmo gairdneri), by Michel Dorson; The principles of therapy in fish diseases, by Roger L. Herman; Some histological techniques applicable to fish tissues, by David Bucke; Some tumours of fish, by Lionel E. Mawdesley-Thomas; Work of the registry of tumours in lower animals with emphasis on fish neoplasms, by John C. Harshbarger; Advances in fish virology: a review 1966-1971, by Ken Wolf; Egtved virus: antigenic variation in 76 virus isolates examined in neutralization tests and by means of the fluorescent antibody technique, by P. E. Vestergard Jørgensen, and Rearing of marine fish - problems of husbandry, nutrition and disease, by Ian D. Richardson.

16291. Yarzhombek, A., and L. Klyashtorin (VNIRO). 1973. LIBERATION OF CARBON DIOXIDE AND AMMONIA BY RAINBOW TROUT SPAWN. (Vydelenie uglekisloty i ammiaka ikroĭ raduzhnoĭ foreli). Rybnoe Khozyaistvo No. 1, p. 21. In Russian.

In the early stages of development rainbow trout spawn up to the formation of the neural tube give off carbon dioxide and ammonia insignificantly (within 0.1 mg per 100 eggs per hour). The liberation of metabolites increases with more intense general metabolism. Toward the end of the first week after hatching of the larvae the amount of ammonia and carbon dioxide given off is close in quantity to the amount of oxygen consumed (around 2 mg per 100 larvae per hour).

16292. Rahn, Hermann, O. Douglas Wangensteen, and Gerald J. Crowley (Dept. of Physiol., State Univ. of N. Y. at Buffalo, Buffalo, New York 14214). 1973. TISSUE O_2 AND CO_2 TENSIONS OF TROUT IN HIGH ALTITUDE LAKES. Trans. Amer. Fish. Soc., 102(1): 132-134.

This report describes preliminary studies of the relationship existing between the water O_2 tension (or content) and the tissue O_2 tensions (PO_2) of trout living in waters of intermediate (7200 ft) and high (> 10,000 ft) altitude of the Sierra Nevada range of East-Central California.

16293. Wheat, T. E., G. S. Whitt, and W. F. Childers (Dept. of Zool., Univ. of Ill. and the Natural History Survey, Urbana, Illinois 61801). 1973. LINKAGE ANALYSIS OF SIX ENZYME LOCI IN INTERSPECIFIC SUNFISH HYBRIDS. The Isozyme Bulletin, Vol. 6, p. 12.

Allelic isozymes have been employed as gene markers for the analysis of linkage relationships in interspecific sunfish (Centrarchidae) hybrids. Male F_1 hybrids (red-ear sunfish Lepomis microlophus X bluegill L. macrochirus) were backcrossed to females of both parental species. The following enzyme systems were resolved by starch gel electrophoresis: Supernatant NAD-malate dehydrogenase (s-MDH A and s-MDH B), an esterase from skeletal muscle, liver α-glycerophosphate dehydrogenase (α-GPDH), tetrazolium oxidase, and 6-phosphogluconate dehydrogenase (6-PGDH). The loci encoding α-GPDH and 6-PGDH underwent recombination at a frequency of $21.7 \pm 9.7\%$ (99% confidence limits) in the backcross to the bluegill and at $15.0 \pm 7.8\%$ in the reciprocal backcross. These frequency of recombination values are not significantly different between the two backcrosses. No other case of linkage was detected, although we were unable to exclude loose linkage. The absence of linkage between the closely homologous s-MDH loci A and B may be the result of tandem duplication followed by chromosomal rearrangement or it may be the result of a very ancient polyploidization event prior to the adaptive radiation of the fishes. The absence of linkage between such closely related loci may be necessary for their separate developmental regulation. (Authors)

16294. Trust, T. J., and A. J. Wood (Dept. of Bacteriol. and Biochem., Univ. of Victoria, Victoria, Brit. Columbia, Canada). 1973. AN INITIAL EVALUATION OF ETHYLENE OXIDE FOR THE STERILIZATION OF FORMULATED AND PELLETED FISH FEEDS. J. Fish. Res. Bd. Canada, 30(2): 269-274.

Satisfactory sterilization of dried pelleted fish foods was achieved with an ethylene oxide-carbon dioxide gas mixture (20:80). The growth rates of juvenile rainbow trout (Salmo gairdneri) fed on feed so sterilized were comparable to or better than those of trout fed the same feed not sterilized. (Authors)

16295. Honma, Yoshiharu, Nobuo Hokari and Eimitou Tamura (Dept. of Biol., Fac. of Sci., Niigata Univ., Niigata, Japan). 1972. STUDIES ON JAPANESE CHARS OF THE GENUS Salvelinus - VI. THE FOOD OF S. leucomaenis. Jap. J. Ichthyol., 19(4): 255-262. In English.

Stomach contents were examined in 106 individuals of Salvelinus leucomaenis collected in the mountain tributary of the Seki-gawa River near the foot of Mt. Myōkō during the period from April through December, 1964. From autumn to spring, stomachs mainly contained aquatic and benthic animals, whereas the land insects were dominant in mid-May through August. Most of these insects were nest-builders and dwellers in and near the river banks, but not good flying ones. Among the aquatic insects taken, the case-bearing caddis worms occupy the highest percentage. This evidence seems to be correlated with the morphological devices of mouth and feeding behavior and accessibility rather than with the preference for food. The fact that the mature fish takes the diet continuously even in the breeding season might be one of the causal factors of no post-spawning death in the land-locked (non-migratory) form. (Authors)

16296. Windom, H., R. Stickney, R. Smith, D. White, and F. Taylor (Skidaway Inst. of Oceanogr., 55 West Bluff Rd., Savannah, Georgia 31406). 1973. ARSENIC, CADMIUM, COPPER, MERCURY, AND ZINC IN SOME SPECIES OF NORTH ATLANTIC FINFISH. J. Fish. Res. Bd. Canada, 30(2): 275-279.

Arsenic, cadmium, copper, mercury, and zinc analyses of 91 individuals representing 35 species of North Atlantic finfish (Chondrichthys and Osteichthys) indicate that these metals occur at similar levels in both inshore and offshore species. Chondrichthys and Osteichthys have similar concentrations of all the metals, excepting arsenic which is higher in Chondrichthys. Analyses of various tissues in Chondrichthys reveal higher metal concentrations in the liver except for mercury which was higher in muscles. (Authors)

16297. Whitt, G. S., J. Shaklee, and K. Kepes (Dept. of Zool., Univ. of Ill., Urbana, Illinois 61801). 1973. SPECIFIC LACTATE DEHYDROGENASE ISOZYME SYNTHESIS IN THE DIFFERENTIATED LIVER OF CYPRINID FISH. The Isozyme Bulletin, Vol. 6, p. 27.

Teleosts possess at least three LDH loci: the A and B loci active to some extent in all tissues and a third LDH locus (E) whose function is restricted to some differentiated tissues. In most orders of teleosts this third LDH locus is characteristically expressed in the retina. However, some orders, e.g. Cypriniformes, have been reported to lack this retinal specific isozyme. Our present study reveals that a number of Cyprinids (lacking the retinal LDH isozyme) do possess a unique LDH in the liver. Two species of barbs, rosy barb (Barbus conchonius) and tiger barb (Barbus sumatranus), as well as goldfish (Carassius auratus) were analyzed. Starch gel electrophoresis reveals the liver specific LDH isozyme migrates more cathodally than the A_4 or B_4 isozymes under a variety of buffer conditions. This distinctive isozyme is the predominant form of LDH synthesized in the liver. Its subunits are observed to polymerize with the A and B polypeptides both in vivo and in vitro. The LDH isozyme of the liver is much more susceptible to heat inactivation than the A_4 and B_4 isozymes. Immunochemical studies indicate that the liver specific LDH is more antigenically related to the E_4 isozyme of the retina of other teleosts than it is to the LDH B_4 of the Cyprinids. We interpret these data as indicating that this isozyme characteristic of the Cyprinid liver and the retinal E_4 isozyme in most teleosts are encoded by the same locus. Thus, in separate groups of fish, this third LDH locus appears to have diverged in both its structure and regulation so that it now functions predominantly in one or the other of two differentiated tissues--retina or liver. (Authors)

16298. Bootsma, R., and C. J. A. H. V. Van Vorstenbosch (Dept. of Special Animal Pathology, Fac. of Vet. Medicine, Univ. of Utrecht, Biltstraat 172, the Netherlands). 1973. DETECTION OF A BULLET-SHAPED VIRUS IN KIDNEY SECTIONS OF PIKE FRY (Esox lucius L.) WITH RED-DISEASE. Reprint of The Netherlands Journal of Veterinary Science, 98(2): 86-90.

Electron microscopical examination of pike fry with red-disease revealed the presence of large numbers of bullet-shaped virus particles in kidney sections. This finding extends the results of earlier experiments in which the viral etiology of red-disease was demonstrated. (Authors' summ.)

16299. Banner, Arnold, and Martin Hyatt (Aquatic Sciences, Inc., 2624 N.W. 2nd Avenue, Boca Raton, Florida 33432). 1973. EFFECTS OF NOISE ON EGGS AND LARVAE OF TWO ESTUARINE FISHES. Trans. Amer. Fish. Soc., 102(1): 134-136.

A simple apparatus was devised to expose eggs and larval fishes to moderate and high noise levels, holding other conditions constant. Viability of eggs and resulting Cyprinodon variegatus larvae was significantly reduced in the noisier tank. Lethal effects of noise were apparently restricted to embryonic C. variegatus; fry exposed subsequent to hatch experienced no losses. Growth rates of C. variegatus and Fundulus similis larvae were significantly greater in the quieter tank under both 8L:16D and 16L:8D photoperiods. Fishes experiencing the longer photoperiod were somewhat shorter, but significantly heavier than those under the shorter photoperiod for the respective noise conditions. (Authors' summ. and conclusions)

16300. Hoffman, G. L. (Eastern Fish Disease Lab., Bur. Sport Fish. & Wildl., Leetown, West Virginia 25430). 1973. PARASITES OF LABORATORY FISHES. Section III, Chapters 21 through 24, pp. 645-779, in Flynn, R. J., 1973, "Parasites of Laboratory Animals", Iowa State Univ. Press, Ames, Iowa, 884 p., $35.00.

This section covers the morphology, life cycle, pathologic effects, diagnosis, control, and public health considerations of the parasites of those fishes used, or considered for use, in work on physiology, toxicology, bioassay, and disease research. Charts and illustrations of species of parasites considered are included. (Auth.)

16301. Hara, T. J., Y. M. C. Law, and E. Van der Veen (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1973. A STIMULATORY APPARATUS FOR STUDYING THE OLFACTORY ACTIVITY IN FISHES. J. Fish. Res. Bd. Canada, 30(2): 283-285.

An apparatus was designed for stimulating the olfactory organs of fishes. The advantage of this apparatus is that it can easily control the stimulus time and the interval between two stimuli either independently or sequentially. The apparatus can also, with slight modification, be applied to the gustatory systems. (Authors)

16302. Miller, E. T., and Gregory S. Whitt (Cell Biol. Program, and Dept. of Zool., Univ. of Ill., Urbana, Illinois 61801). 1973. LDH E_4 ISOZYME SYNTHESIS DURING RETINAL DIFFERENTIATION. The Isozyme Bulletin, Vol. 6, p. 20.

In many species of teleosts there is a distinctive lactate dehydrogenase isozyme whose synthesis occurs primarily in the neural retina, and particularly in the photoreceptor cells. In the present study, a fine structure analysis of the sunfish retina was undertaken, particularly of the ellipsoid region where the E_4 LDH is located. We have also attempted to resolve the issue of whether the onset of LDH E_4 synthesis is dependent upon hatching and increased aerobiosis or whether this onset is tied in with retinal differentiation. The LDH isozyme patterns of the green sunfish (Lepomis cyanellus), bluegill (Lepomis macrochirus), and several interspecific sunfish hybrids were examined by starch gel electrophoresis during the course of development. The expression of the LDH E gene was not detected until well after hatching, three to four days after the eye has become completely pigmented. These results are consistent with the E_4 isozyme synthesis being related to differentiation of the neural retina. In order to correlate the state of differentiation of the photoreceptor cells (and their organelles) with the onset of the E_4 isozyme synthesis, we have undertaken a detailed study at the electron microscope level. Thin sections, obtained from green sunfish embryos collected at 12 hour intervals from five days before to two days after the E_4 appearance, were analyzed. (Authors)

16303. de Kinkelin, P., B. Galimard, and R. Bootsma (Fish Pathology Lab., Nat'l Inst. of Agric. Research, Sta. of Virol. and Immunol., 78850 Thiverval-Grignon, France). 1973. ISOLATION AND IDENTIFICATION OF THE CAUSATIVE AGENT OF "RED DISEASE" OF PIKE (Esox lucius L. 1766). Nature, 241(5390): 465-467.

Work is described which demonstrates that "Red Disease" of pike is caused by a rhabdovirus.

16304. Hare, G. M. (Dept. of Biol., Univ. of New Brunswick, Fredericton, New Brunswick, Canada). 1973. A MODIFIED STAKE NET FOR COLLECTING MIGRATING SMOLTS OF ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. of Canada, 30(1): 128-129.

A modified stake net for collecting smolts of Atlantic salmon (Salmo salar) is described. The net is efficient for trapping smolts and, in addition, it practically eliminates problems with mortality of captured fish and accumulation of debris in the trap. (Auth.)

16305. Allen, K. Radway (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1973. THE APPLICATION OF RESEARCH TO THE MANAGEMENT OF BRITISH COLUMBIA SOCKEYE SALMON. Trans. Amer. Fish. Soc., 102(1): 172-177.

The sockeye salmon (Oncorhynchus nerka) which is native to the Pacific rim from California to Kamchatka is the most valuable single species in the British Columbia fishery. Recently catches have ranged from 2 to 7 million fish with a landed value of $4-$16 million annually, and have generally constituted 20-30% by value of total landings. Sockeye salmon, like other anadromous fish, provide greater opportunities for research to have an impact on their management than do most marine species. On the one hand, they are particularly susceptible to the adverse influences of excessive fishing and of changes in the freshwater environment, both of which provide scope for remedial management. On the other hand, during the freshwater phases, they are relatively easy to observe and, particularly during migrations, there are exceptionally good opportunities for quantitative assessment of populations. In Canada, research has contributed directly to the management of sockeye salmon in at least the following ways: 1. By maintaining or increasing the productivity of the accessible freshwater environment through - (a) identifying and providing means of overcoming barriers to access to spawning and rearing grounds, e.g. Hell's Gate Rapids; (b) identifying situations in which potential rearing capacity exceeds the output of existing spawning grounds, e.g., Babine Lake; (c) identifying the essential features of productive spawning grounds and so providing a basis for construction of additional spawning grounds to meet the above situation, e.g., spawning channels; (d) identifying situations in which the productive capacity of rearing lakes is inadequate for the spawning grounds and devising remedial measures, e.g., Great Central Lake; (e) providing a basis for assessing potential adverse effects of proposed environment modifications and thus for opposing or modifying such actions, e.g., hydroelectric development. 2. By understanding the relationship between spawning escapement and size of the next generation, thus providing a basis for determining the optimum escapement level for each stock. 3. By identifying the origin of fish occurring in the fishery or in the ocean at various times and places. This identification provides a basis, both for regulation to obtain optimum escapements to individual runs, and for the appropriate sharing of ocean catches between salmon-producing nations, e.g., United States and Canadian coho salmon (O. kisutch) fisheries, and high seas salmon fisheries under the International North Pacific Fisheries Commission. While much research has been aimed directly at the solution of these practical problems, it could not have achieved these ends without the background of much past and present research on all aspects of the biology and life history of the species. (Auth.)

16306. Burton, W., and John F. Flannagan (Dept. of the Environ., Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba R3T 2N6, Canada). 1973. AN IMPROVED EKMAN-TYPE GRAB. J. Fish. Res. Bd. Canada, 30(2): 287-290.

An improved Ekman-type grab with top lids, which are locked open during descent and weighted to keep them closed during retrieval, is described. In comparative trials with a Wildco Tall 6-inch Birge-Ekman, the new grab collected significantly more chironomids and oligochaetes, and about the same number of the heavier and larger animals such as gastropods, sphaeriids, trichopterans, etc. The new design also improvies the versatility and mechanical reliability of the grab. (Authors)

16307. Sylvester, J. R. (NMFS, No. Pacific Fish. Res. Center, 2725 Montlake Blvd East, Seattle, Washington 98102). 1973. EFFECT OF LIGHT ON VULNERABILITY OF HEAT-STRESSED SOCKEYE SALMON TO PREDATION BY COHO SALMON. Trans. Amer. Fish. Soc., 102(1): 139-141.

It is suggested from experiments that heat-stressed sockeye salmon prey under natural conditions will have increased vulnerability at night as well as during the day, although darkness would afford greater protection against some predators.

16308. Wedemeyer, G. A., and A. J. Ross (Bur. of Sport Fish. & Wildl., Western Fish Dis. Lab., Sand Point N.S.A., Seattle, Washington 98115). 1973. NUTRITIONAL FACTORS IN THE BIOCHEMICAL PATHOLOGY OF CORYNEBACTERIAL KIDNEY DISEASE IN THE COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 30(2): 296-298.

The influence of diet ingredient on the morbidity and biochemical pathogenesis of corynebacterial kidney disease was investigated using juvenile coho salmon (Oncorhynchus kisutch) fed the Abernathy dry ration made up with either corn gluten or cottonseed meal (isoprotein, isocaloric substitution). Evaluation of incidence of infection, pituitary activation and aspects of carbohydrate metabolism, acid-base balance, renal function, and hematopoietic activity showed that the actual disease incidence was about the same for both diets but the nonspecific stress of infection was more severe in fish fed the corn gluten. Discriminant function calculations combining four physiological parameters gave a probability of 0.86 for successfully diagnosing infected fish on the basis of these blood chemistry tests. (Authors)

16309. Koch, David L. (Dept. of Biol., Univ. of Nevada, Reno, Nevada 89507). 1973. REPRODUCTIVE CHARACTERISTICS OF THE CUI-UI LAKESUCKER (Chasmistes cujus Cope) AND ITS SPAWNING BEHAVIOR IN PYRAMID LAKE, NEVADA. Trans. Amer. Fish. Soc., 102(1): 145-149.

Pyramid Lake provides suitable habitat for adult cui-ui, but becomes limiting for the development and hatching of the eggs. The continued diversions of the Truckee River have eliminated access to ancestral spawning areas by the cui-ui. The diversions of the river have also caused a decline in the level of Pyramid Lake which is becoming more limiting to the cui-ui as ion concentrations increase. During 1971, cui-ui were observed spawning in Pyramid Lake for the first time. Cui-ui males and females can be easily distinguished in the breeding condition. The males are smaller than the females and are densely covered with pearl organs. The females are more robust than the males and do not exhibit a pinkish lateral stripe present on the males. The spawning sites are in clear, cool waters and have bottom gravel fine to coarse in texture. These sites are located near tributary streams where bottom gravels are clean. One female is attended by 2-6 males during the spawning act, and she spawns 4-5 times before returning to deep water. Cui-ui spawning is marginal at best in Pyramid Lake due to heavy predation by the tui-chubs on the fertilized eggs and parasitism on the eggs by the fungus Saprolegnia sp. Thus, efforts should and are being made to artificially propagate this species before its ultimate extinction under present conditions. (Auth. summ.)

16310. Jessop, B. M., and G. Power (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1973. AGE, GROWTH, AND MATURITY OF ROUND WHITEFISH (Prosopium cylindraceum) FROM THE LEAF RIVER, UNGAVA, QUEBEC. J. Fish. Res. Bd. Canada, 30(2): 299-304.

Data on the age, growth, and maturity of round whitefish (Prosopium cylindraceum) from the Leaf River, Ungava, generally confirmed or extended observations previously reported for two other Ungava rivers. On the basis of back-calculated lengths, Leaf and Koksoak River round whitefish had similar growth rates except that the Leaf River specimens showed an atypical decrease in the second year. Scale increments in the year of the study suggested that the growing season extended from mid-June to mid-September. Both sexes matured at ages 4-6, but proportionately more females than males were mature at ages 4 and 5. Females matured at lengths between 190-199 mm and 240-249 mm while males matured at lengths 10-20 mm greater, as in the Koksoak River. Apparently, not all mature females spawned annually. (Authors)

16311. Harrington, David L. (Univ. of Georgia, Marine Resources Extension Program, Brunswick, Georgia). 1972. THE VIEWPOINTS OF COMMERCIAL FISHERMEN ON ARTIFICIAL REEFS. Proc. of Sport Fishing Seminar, Nov. 18-19, 1971, Jekyll Island, Georgia, Coastal Plains Center for Marine Development Services Seminar Series No. 1, pp. 15-16, 1972.

16312. Hunding, C., and B. T. Hargrave (Freshwater Biol. Lab., The Univ. of Copenhagen, Hellerød, Denmark). 1973. A COMPARISON OF BENTHIC MICROALGAL PRODUCTION MEASURED BY C^{14} AND OXYGEN METHODS. J. Fish. Res. Bd. Canada, 30(2): 309-312.

A comparison of estimates of benthic primary production on a sandy beach measured by in situ oxygen and laboratory C^{14} methods showed that both methods gave similar measures of the magnitude of production. Sources of error in each method are discussed. Measures of C^{14} uptake offer sensitivity when production is low, but when undisturbed sediment cores can be obtained, production is most easily measured by following changes in dissolved oxygen. (Authors)

16313. Korn, Sidney (Bur. of Sport Fish. & Wildl., Fish-Pesticide Research Lab., Columbia, Missouri 65201). 1973. THE UPTAKE AND PERSISTENCE OF CARBARYL IN CHANNEL CATFISH. Trans. Amer. Fish. Soc., 102(1): 137-139.

The mean total residues of ^{14}C-labeled carbaryl and its metabolites and degradation products accumulated by channel catfish during exposure to 2.8 mg/kg per week in the feed was 9 ng/g. Mean total residues accumulated from bath exposure to 0.25 mg/l was 11 ng/g. The low treatment groups, 0.28 mg/kg per week in diet and 0.05 mg/l in bath, accumulated 1 and 2 ng/g, respectively. The total insecticide residues were dose-dependent for both bath and feed exposures. Fish exposed via diet accumulated less than 1% of the available pesticide, whereas fish exposed via bath retained .0001% carbaryl and/or metabolites and degradation products. Fish exposed to 2.8 mg/kg per week by diet eliminated residues rapidly after they were placed on a carbaryl-free diet for 28 days. They retained a mean of only 2 ($\pm$ S.D. 0.3) ng/g. Residues remained constant for 28 days in fish previously exposed to 0.25 mg/l carbaryl in their bath for 56 days. Probably little carbaryl should reach aquatic environments due to the instability of the compound. Research should be done on metabolite composition and persistence of alpha-napthol.

16314. Duval, W. S., T. J. Brown, and G. H. Geen (Dept. of Biol. Sci., Simon Fraser Univ., Burnaby 2, British Columbia, Canada). 1973. A SUBMERSIBLE SPECTRORADIOMETER AND DATA ACQUISITION SYSTEM. J. Fish. Res. Bd. Canada, 30(2): 313-316.

A submersible light meter that measures and records irradiance versus wavelength over the range 400-750 nm is described. A data acquisition system coupled to the radiometer permits collection and processing of large numbers of field observations. The incident spectrum is determined by an optical system incorporating a wedge interference filter monochromator and photodiode. Recorded data are converted to spectral irradiance ($\mu w\ cm^{-2} nm^{-1}$) at 5-nm intervals by applying standard lamp calibration and immersion factor corrections. Minimum detectable radiation varies from 0.05 to 0.016 $\mu w\ cm^{-2} nm^{-1}$ depending on wavelength. Response of the meter is not affected by temperature in the range of 3.5-23.0 C and angular dependence of the light collector follows Lambert's Cosine Law for incident angles less than 55° from the vertical. Changes in the spectral composition of incident light with depth are demonstrated for two lakes. (Authors)

16315. Wilson, F. Ray, Gregory S. Whitt, C. Ladd Prosser (Depts. of Physiol. & Biophysics & Zool., Univ. of Ill., Urbana Illinois 61801). 1973. LACTATE DEHYDROGENASE AND MALATE DEHYDROGENASE ISOZYME PATTERNS IN TISSUES OF TEMPERATURE ACCLIMATED GOLDFISH (Carassius auratus L.) The Isozyme Bull., Vol. 6, p. 20.

16316. Wallace, Charles R. (Dept. of Biology, Pan American Univ., Edinburg, Texas 78539). 1973. EFFECTS OF TEMPERATURE ON DEVELOPING MERISTIC STRUCTURES OF SMALLMOUTH BASS, Micropterus dolomieui Lacépède. Trans. Amer. Fish. Soc., 102(1): 142-144.

Definite relationships were found between temperature and the mean numbers of lateral line scales, anal spines, and dorsal soft fin rays of smallmouth bass. (From Results)

16317. Coble, Daniel W. (Wis. Coop. Fish. Unit, Univ. of Wis., Stevens Point, Wisconsin 54481). 1973. INFLUENCE OF APPEARANCE OF PREY AND SATIATION OF PREDATOR ON FOOD SELECTION BY NORTHERN PIKE (Esox lucius). J. Fish. Res. Bd. Canada, 30(2): 317-320.

Northern pike (Esox lucius) were put in tanks with fantail and regular-tail goldfish (Carassius auratus) or with goldfish of different colors. Physical appearance of prey did not affect the pike's feeding. In experiments in plastic pools four species of fish were exposed to predation by northern pike that were satiated or deprived of food for either 2 or 4 weeks. The pike always selected carp (Cyprinus carpio) and fathead minnow (Pimephales promelas) over green sunfish (Lepomis cyanellus)and bluegill (L. macrochirus). (Auth.)

16318. Talbot, G. B. (Bur. of Sport Fish. & Wildl., Washington, D. C.). 1973. THE CALIFORNIA SARDINE-ANCHOVY FISHERIES. Trans. Amer. Fish. Soc., 102(1): 178-187.

The Pacific sardine (Sardinops sagax) fishery in California reached a peak in the 1936-37 season when over 700,000 short tons were harvested. After 1945 there was a drastic decline in catch to a low of 4,000 tons in the 1953-54 season. The anchovy (Engraulis mordax) fishery has always been much smaller because of low demand and regulations against reduction. An almost continuous controversy has existed over these fishes concerning their reduction to oil and meal. Research has been carried out on sardines for many years and more recently on anchovies by the California Department of Fish and Game, the U.S. Fish and Wildlife Service, Scripps Institution of Oceanography, California Academy of Sciences, and the Hopkins Marine Station. Causes of the collapse of the sardine populations have been argued for many years, and it now seems agreed that the major factor was overfishing plus a series of poor year classes. No adequate regulations have ever been imposed on the fishery, partially because of the dual nature of regulatory power. The California State Legislature retains the right to regulate the fishery but has delegated the right to issue reduction permits to the Fish and Game Commission. With the decline in sardines after 1945, the fishing industry increased pressure to allow the catch of anchovies for reduction to meal and oil. Conservation groups have been and still are opposed to such use on the basis that it has not yet been possible to manage the sardine fishery, that forage fish are necessary for the well-being of sport and commercial species, and that research should be carried out on anchovies before an anchovy reduction fishery begins. Anchovy bait fishermen also protested since historically they have had trouble obtaining sufficient fish and believe that a reduction fishery would ruin their business. After lengthy hearings the Fish and Game Commission in 1965 allowed an experimental anchovy reduction fishery with yearly quotas which have ranged from 75,000 to 140,000 short tons. The commercial fishery has never caught the allowable quota. Many reasons for poor anchovy catches have been given, such as too low a quota to make it worthwhile to fish and uncertainty of future regulations to risk additional investment, but the main reason appears to be that the price paid to fishermen is too low to allow a profitable fishery. Processors cannot pay more and effectively compete with world fish meal prices. Rational management of these species probably will not be achieved until control of the sardine fishery is placed in a single conservation agency that is quickly responsive to the needs of the resource, a step that has been advocated by California conservation groups for many years. (Auth.)

16319. Warner, Kendall (Maine Dept. of Inland Fisheries and Game, UMB 34, Idaho Avenue, Bangor, Maine 04401). 1973. SPRING FOOD OF CHAIN PICKEREL (Esox niger) IN MAINE LAKES. Trans. Amer. Fish. Soc., 102(1): 149-151.

Of 281 pickerel examined, 218 (77.6%) contained food. Yellow perch was the most abundant fish species identified in the stomach contents of pickerel, followed by white perch and rainbow smelts. Other fishes found included: sunfish, white sucker, pickerel, smallmouth bass, and minnows.

16320. Wheat, T. E., G. S. Whitt, and W. F. Childers (Univ. of Ill. and Ill. Nat. History Survey, Urbana, Ill.). 1972. LINKAGE RELATIONSHIPS AMONG SIX ENZYMES IN INTERSPECIFIC SUNFISH HYBRIDS. Genetics, 71(3), part 2, p. 67.

16321. Boudreault, F.-Robert, and J. Pierre Laprise (Service de la Recherche, Direction des Pêches maritimes, Ministère de l'Industrie et du Commerce, Hôtel du Gouvernement, Québec). 1973. TOWARD AN OBJECTIVE ANALYSIS OF THE SEASONAL THERMOCLINE. (Vers une analyse objective de la thermocline saisonnière). J. Fish. Res. Bd. Canada, 30(2): 320-322.

We propose a definition of the seasonal thermocline, based on a generalization suggested by Riffenburgh (1970). This allows objective analysis of the thermocline. (Authors)

16322. Freeman, Robert A. (Dept. of Fish. & Wildl. Biol., Colorado State Univ., Fort Collins, Colorado 80521). 1973. RECOVERY OF RAINBOW TROUT FROM ALUMINUM POISONING. Trans. Amer. Fish. Soc., 102(1): 152-154.

Reduction of symptoms of aluminum poisoning occurred rapidly among recovering rainbow trout. It is suggested that neither brief nor extended contact with lethal amounts of both soluble and/or insoluble aluminum will have persistent effects on the growth potential of surviving trout.

16323. Macek, K. J., and Robert N. Sturm (Bionomics, Inc., Wareham, Massachusetts 02571). 1973. SURVIVAL AND GILL CONDITION OF BLUEGILL (Lepomis macrochirus) AND FATHEAD MINNOWS (Pimephales promelas) EXPOSED TO SODIUM NITRILOTRIACETATE (NTA) FOR 28 DAYS. J. Fish. Res. Bd. Canada, 30(2): 323-325.

Acute dynamic bioassays with fathead minnows and rainbow trout indicated that the 96-hr median tolerance limits of sodium nitrilotriacetate (NTA) exceed 1000 times the mean environmental levels that might be anticipated from detergent use. A 28-day dynamic bioassay with bluegill and fathead minnows indicated a lack of cumulative toxicity associated with levels of NTA up to 1000 times expected environmental concentrations in water. Fishes exposed to 96 mg/liter NTA for 28 days exhibited no NTA-induced gill pathology. (Authors)

16324. Kepes, K. L., and G. S. Whitt (Univ. of Ill., Urbana, Illinois). 1972. SPECIFIC LACTATE DEHYDROGENASE GENE FUNCTION IN THE DIFFERENTIATED LIVER OF CYPRINID FISH. Genetics, 71(3): part 2, p. 29.

16325. Smith, Wesley E. (U.S. Environ. Protection Agency, Nat'l Water Qual. Lab., Duluth, Minnesota 55804). 1973. A CYPRINODONTID FISH, Jordanella floridae, AS A LABORATORY ANIMAL FOR RAPID CHRONIC BIOASSAYS. J. Fish. Res. Bd. Canada, 30(2): 329-330.

The flagfish (Jordanella floridae) is proposed as a useful laboratory fish for chronic toxicity studies. It matures rapidly, reaching breeding age in 6-8 weeks under optimum conditions, and the fish will spawn at any time of the year. The adults are sexually dichromatic. A complete chronic test may be conducted with this species in as little as 3-4 months. (Auth.)

16326. Bryant, Horace E., and Alfred Houser (So. Central Reservoir Investigations, Bur. Sport Fish. & Wildl., Fayetteville, Arkansas). 1971. POPULATION ESTIMATES AND GROWTH OF LARGEMOUTH BASS IN BEAVER AND BULL SHOALS RESERVOIRS. Reprint from Reservoir Fisheries and Limnology, Spec. Publication No. 8 of the Amer. Fish. Soc., pp. 349-357.

Using electrofishing gear, the authors made shoreline population estimates of largemouth bass, Micropterus salmoides (Lacépède), in large coves on Beaver and Bull Shoals Reservoirs during April 1969 and 1970. Population estimates of bass in Beaver Reservoir for 1969 and 1970 were 393 and 253 per kilometer of shoreline. Shoreline estimates made during 1969 and 1970 in Bull Shoals Reservoir were 271 and 127 per kilometer. In Beaver Reservoir, the weighted average calculated total lengths of largemouth bass at the end of each year of life, ages 1 through 6 years, were 152, 277, 333, 396, 462, and 474 millimeters. For Bull Shoals Reservoir, the total lengths for ages 1 through 8 years were 176, 297, 377, 427, 457, 492, 519 and 524 millimeters. (Authors)

16327. Spangler, William J., James L. Spigarelli, Joseph M. Rose, and Hope M. Miller (Midwest Res. Inst., Kansas City, Missouri). 1973. METHYLMERCURY: BACTERIAL DEGRADATION IN LAKE SEDIMENTS. Science, 180(4082): 192-193.

During the first 50 days of a long-term period of incubation of lake sediments with inorganic mercury (Hg^{2+}), low concentrations of methylmercury were observed to build up. Upon continued incubation there was a rapid decrease in amount of methylmercury in the system and a concomitant evolution of volatile inorganic mercury (Hg^0). Transfer of the mixed culture to growth media containing methylmercury resulted in the degradation of methylmercury and the volatilization of Hg^0. Four bacterial isolates were obtained from the mixed culture which, in pure culture, rapidly degraded methylmercury to methane and Hg^0. The presence of methane in head space gases was confirmed by flame-ionization gas chromatography, and the presence of Hg^0 in head space gases was confirmed by mass spectrometry. (Authors)

16328. Green, John M. (Marine Sci. Res. Lab., Memorial Univ., St. John's, Newfoundland, Canada). 1973. EVIDENCE FOR HOMING IN THE MOSSHEAD SCULPIN (Clinocottus globiceps). J. Fish. Res. Bd. Canada, 30(2): 129-130.

Observations on 86 tagged mosshead sculpins (Clinocottus globiceps) show that this species exhibits fidelity to specific tide pools and returns to them when displaced to other tide pools. (Auth.)

16329. Bridges, Colton H., and Louis S. Hambly (Mass. Div. of Fish. & Game, Westboro, Massachusetts). 1971. A SUMMARY OF EIGHTEEN YEARS OF SALMONID MANAGEMENT AT QUABBIN RESERVOIR, MASSACHUSETTS. Reprint from Reservoir Fisheries and Limnology, Spec. Publication No. 8 of the Amer. Fish. Soc., pp. 243-254.

Quabbin is a deep, soft-water reservoir with two-thirds of the volume consisting of cold-water habitat. Three fisheries management programs have been implemented: lake trout-walleye, 1952-60; lake trout-brown trout-rainbow trout, 1957-65; and lake trout-landlocked salmon, 1965-70. During the initial management program, walleye establishment failed. Lake trout and brown trout were the most successful in the second program. The lake trout and landlocked salmon program shows signs of success. Throughout the three programs, rainbow smelt abundance has fluctuated primarily due to a chemical control program instituted to reduce the population which was interfering with the water supply distribution system. (Authors)

16330. Yin, S. C., R. C. Summerfelt, and A. K. Andrews (Coop. Fishery Unit, Okla. State Univ., Stillwater, Oklahoma 74074). 1972. DRIED CATTLE PAUNCH MANURE AS A FEED SUPPLEMENT FOR CHANNEL CATFISH. Proc. Okla. Industrial Wastes and Ad. Water Conf., 23: 75-82.

The rumen contents of cattle, referred to as paunch manure, are the remains of the ingested food which were partially digested through microbial action. The high solids content and an extremely high BOD (100,000 mg/kg fresh weight) of paunch makes it difficult to treat in any sewage treatment system, and if dumped into rivers, as has been the case in the past, it has a detrimental effect on aquatic life. Paunch dried (6.8% moisture) with a mechanical dehydrator has a desirable composition for use in formulated animal feeds: 12.7% protein, 3.1% fat, and 40.8% carbohydrate. The authors present evidence which shows that dried paunch were negative for Salmonella. An experiment is described for testing the suitability of paunch as an ingredient in formulated feed for channel catfish. (Authors)

16331. Lark, John G. I. (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1973. AN EARLY RECORD OF THE SEA LAMPREY (Petromyzon marinus) FROM LAKE ONTARIO. J. Fish. Res. Bd. Canada, 30(2): 131-133.

An 1835 record of the sea lamprey (Petromyzon marinus in Lake Ontario is related to a hypothesis that it entered the lake through the Erie Canal after 1819. (Auth.)

16332. Toetz, D. W., R. C. Summerfelt, and J. Wilhm (Coop. Fishery Unit, Okla. State Univ., Stillwater, Oklahoma 74074). 1972. BIOLOGICAL EFFECTS OF ARTIFICIAL DESTRATIFICATION AND AERATION IN LAKES AND RESERVOIRS--ANALYSIS AND BIBLIOGRAPHY. U. S. Dept. Interior, Bur. of Reclamation (Denver, Colorado) Rept. REC-ERC-72-33., 117 p, 19 fig, 337 ref.

The state-of-the-art of research concerning the biological effects of reaeration and destratification is described, with emphasis on lakes and reservoirs. Research needs are discussed, based on this review. Useful descriptions of methods and devices for reaeration and destratification and a comprehensive annotated bibliography of 337 references are included. (Authors)

16333. Rutledge, William P., and John C. Barron. 1972. THE EFFECTS OF THE REMOVAL OF STUNTED WHITE CRAPPIE ON THE REMAINING CRAPPIE POPULATION OF MERIDIAN STATE PARK LAKE, BOSQUE, TEXAS. Texas Parks & Wildlife Dept. Technical Series No. 12, 41 p., illus.

The problem of overcrowding and stunting of white crappie populations has plagued fishery management efforts throughout the years. Review of existing literature indicates that crappie stunting is related to the formation of dominant year classes. It is felt that competition, either intra- or interspecific in nature, within these dominant year classes, perhaps at the point where crappie switch to piscivorous food, is responsible for white crappie stunting. Methods of correcting stunted fish populations have ranged from increasing the food supply to reducing the existing population through biological, chemical, or mechanical means. Biological control has met with limited success; chemical renovation, although effective, is restricted by cost and clearance problems; while mechanical reduction has been successful, however, this success seems to be correlated with the intensity and continuity of removal operations. In an effort to evaluate the effects of the removal of stunted white crappie on the remaining crappie population of Meridian State Park Lake, a total of 3,617 white crappie weighing 668.38 pounds were removed from the lake in 1969. This represents a removal effort of 9.54 pounds of white crappie per acre or a reduction in the standing crop of approximately 29.35 percent. Comparison of pre- and post-removal factors such as average size and length frequency of angler-caught white crappie and multiple regression analysis of length-weight statistics indicates that the remaining white crappie were actually larger one year after removal operations. The significance of this difference, although not as high as had been expected, is thought to be related to the intensity of removal. Review of pertinent literature and results of this experiment indicate that the solution of overcrowding and stunting in white crappie populations may lie in the prevention of the formation of dominant year classes. Suppression of reproduction by chemical means of water level fluctuation and mechanical reduction of young-of-the-year crappie within the dominant year class may have application towards this end. (Authors)

16334. Summerfelt, R. C. (Coop. Fishery Unit, Okla. State Univ., Stillwater, Oklahoma 74074). 1970. PLANNING REQUIREMENTS FOR FEE FISHING PONDS. In J. G. D. Nard (ed.), Proc. Missouri Catfish Conf., March 10-11, 1970, Univ. of Missouri, Columbia, Mo., pp. 21-29.

Recreational fishing is identified as an important market for farm-reared channel catfish. Catfish sold to farm and ranch pond owners, sportsmen clubs, and put-and-take lakes generally bring a higher return to pond owners than fish going to the processing plant. The author compares catch-out ponds and put-and-take ponds for recreational fishing. Planning requirements discussed include predicting demand, location, fees, fish, insurance and regulations. (Auth.)

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